THE

ELECTRICAL REVIEW.

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THE NEW PATENT ACT APPEALS.

IN our issues of February 19th and March 5th last, we dealt with the revocation by the Comptroller-General of Letters Patent No. 18,786 of 1902 (Bremer), and No. 23,606 of 1902 (Hogner), respectively, and we last week recorded that the revocations had been annulled on appeal.

It may be recalled that the Bremer patent was owned by the British Westinghouse Co., and the Hogner patent by Messrs. Koerting & Mathiesen, represented in England by the Union Electric Co. The two patents cover the same ground to such an extent that the Comptroller-General said that it seemed to him the Hogner patent was in substance anticipated by the Bremer patent. The British Westinghouse Co. started the manufacture of the Bremer lamp, but found difficulties, and, from the point of view of commercial sales, met with but qualified success. Messrs. Koerting and Mathiesen had developed the Hogner lamp, from the manufacturing standpoint, to such good purpose as to enable the Union Electric Co. to make satisfactory commercial sales.

It seems to have been generally recognised that the Hogner patent was open to the criticism of having been anticipated by Bremer, but, as sometimes happens with rival interests, doubts were cast upon the validity of the latter by reason of want of conformity between the provisional and complete specifications. In the circumstances then existing, the respective owners made a sensible commercial arrangement ratified by an agreement dated March 12th, 1906. Under this agreement, Koerting & Mathiesen obtained a licence under the Bremer patent at a royalty, and the British Westinghouse Co. obtained a licence without royalty under the Hogner patent. Having composed the differences between themselves, they found that importations of lamps were being made by Mr. Braulik, which were alleged to be infringements. The British Westinghouse Co. issued a writ against Mr. Braulik on January 2nd, 1908, and delivered a statement of claim in July. A defence was put in on November 12th, but in the meantime (October 20th) an application had been made by Mr. Braulik to revoke the patents. The application met with success before the Comptroller, but it has been doomed to failure before the judge on appeal.

Revocation obviously must depend upon the evidence submitted by whomsoever produced, but when the applicant regards revocation as a short cut to the removal of an infringement suit, he is hardly entitled to an unduly benevolent attitude on the part of the tribunal. In commenting on the Hogner case (March 5th), we had occasion to remark that "the full strength and relevancy of an argument may not always be conveyed when set forth in an abbreviated form to be subsequently demolished at greater length," and clearly it is difficult to attach a proper value to evidence imperfectly conveyed. The Comptroller-General was not allowed to see in its entirety the agreement which formed so important a feature in the case, and it may be due

to this fact that, in his report of the proceedings before him, an unsatisfactory impression was left on the reader's mind as to the nature of the agreement. It is therefore the more gratifying to find that in the appeal proceedings the judge (who presumably had the full agreement before him) found not only that there was no need to make any unfavourable comment upon its conditions, but that so far from being a deterrent to British manufacture, it handicaps "Koerting and Mathiesen to the extent of the royalty imposed on them," and obtains for the British Westinghouse Co. "a free licence in respect of the Hogner patent, thus using their patent rights to increase, and not to diminish, the chance of being able to establish an industry in arc lamps in this country." The evidence, both before the Comptroller and the Judge, establishes the fact that whatever the tendency of the agreement, the results achieved had not been satisfactory from the point of view of British manufacture, since a far larger number of imported lamps had been sold than those of home make. Mr. Justice Parker, upon all the evidence, was of opinion that "the company have throughout used, and are still using, their best endeavours to fulfil the obligation arising under the Act of 1907," and "that their want of success up to the present time has been due to circumstances beyond their own control." The Comptroller-General was impressed with the fact that even if the agreement disclosed satisfactory reasons why the British Westinghouse Co. were unable to manufacture more largely under the Bremer patent, it did not explain why the German company did not manufacture their lamps in the United Kingdom. Mr. Justice Parker, on the other hand, finds "some excuse for hesitating to lay down plant with a view to working Hogner's patent in this country" until the validity of the Bremer patent (regarding which litigation has for some years been pending) had been decided.

The result of the appeal in these cases will, we believe, be received with general satisfaction. Whether or not the unsatisfactory impression produced by the Comptroller-General's decision was due to the imperfect evidence placed before him, the result of the appeal only accentuates the confidence universally felt in the impartial administration of the law in the English Courts. Just what the Act of 1907 was meant to do is the subject of more or less conflicting statements by rival claimants to the credit for its introduction and passing, but in Mr. Justice Parker's opinion it "was never meant to penalise want of success when the patentee has done his best," nor do we believe that it was intended to bestrew with rose leaves the path of the defendant to an infringement suit on imported apparatus, although it must be recognised that in certain cases an application for revocation may be very properly made by such a defendant.

In time the drawbacks in the administration of the Act may be removed. The new rules issued with commendable promptitude by the new Comptroller-General at the suggestion of Mr. Justice Parker, prevent the use of the Act for merely "fishing" purposes, and we do not doubt that, as further changes are shown to be necessary, they will be made, but no changes in the details of administration can alter the general character of the Act, the detrimental tendency of which we alluded to in our issue of January 1st. Lord Alverstone, the Lord Chief Justice of England, who, as Sir Richard Webster, was the leading Patent Counsel of his day, expressed his opinion of the Act on Friday last before the International Congress on Applied Chemistry. Presiding over the section for the discussion of law, political economy, and legislation affecting the chemical industry, he said that "a real step backward had been make in the revoking clause of the new Patent Law. It would only result in people keeping their inventions secret and not taking out an English patent. The Patent Law should give protection to the inventor, and also secure the interests of the public. The inventor should have a fair and reasonable reward for his labours." Lord Alverstone added that the new Law had been made against his will and wish, and he thought that "if it were changed to a more liberal standard, viz., the standard of a compulsory licence, there would be no temptation to inventors to keep their invention secret."

It will probably need more hard cases than have yet arisen, and more definite evidence of detrimental operation than can yet have been possible, before any change will be effected in the Act itself. We do not doubt that the expediency of such a change will in the course of time be sufficiently demonstrated, and in the meantime patentees must be content with a "more liberal standard" in the methods of its administration, an example of which is to be found in Mr. Justice Parker's decision revoking the revocations.

Code Telegrams.

THE letter system of charging when calculating the cost of a telegram, advocated repeatedly in our columns, appears to be a step nearer realisation. The Chairman of the Eastern Telegraph Co. when presiding at the ordinary general meeting of the company on 12th ult., stated that the Convention "allowed any pronounceable combination up to 10 letters to be accepted, but combinations composed of *bona-fide* words were excepted. 'Abobarbate' was accepted as a legitimate combination, but 'canyoucome,' whether used as plain language or joined together as a code word, was charged as three words. This regulation had given rise to many disputes between their customers and themselves." It is a matter of common knowledge that since the new rules for counting came into force considerable friction has arisen between the telegraphing public and the cable companies, who, by reason of stress of competition, are being driven from strictly interpreting the rules for counting and losing custom, to accepting anything up to 10 letters, pronounceable or not; and even if made up of *bona-fide* words, such as "canyoucome." That the state of affairs has become serious is evidenced by the remarks of Sir John Wolfe-Barry, who speaks not only for the Eastern but for all the associated companies. The friction has now become universal and unbearable, and if the Governments do not see their way to adopt the system of counting on a basis of 10 letters to a word owing to the loss it would entail, why do they not, as we have before stated, reduce the number to a fair average of, say, seven letters, and accept anything up to this limit as one word, without any regard as to how it is written? There are also many distinctions made by Governments in charging and counting when dealing with inland and foreign telegrams, which are annoying to the public and mean little to the Governments concerned, and it is most desirable that uniformity should be striven for in this direction.

The St. Petersburg Tramway Transaction.

A TRANSACTION involving an expenditure of £5,000,000 (50,000,000 roubles) in connection with the St. Petersburg tramways, is reported to be in progress at the present time, and the interests associated with it are said to be representative of financial circles in Germany, England and Belgium. Finance, or the support of banks, appears in this operation, as in so many other cases, to be the backbone of the business. The municipal council of St. Petersburg resembles so many other Russian local authorities in the sense of being unable, owing to a variety of reasons, to raise loans except on terms which are distinctly unfavourable to

the borrowers, and the idea has consequently occurred that it would be desirable to dispose of the tramway system to a company for the purpose of development in directions which are now deemed to be necessary. The precise situation of the tramways in the Russian capital is not very clear, and the information which filters through from German sources leaves very much to be desired from a general standpoint. It seems, however, that a portion of the network is worked by horse cars and a portion by electricity. The latter was converted by the Westinghouse Co.—we believe the American Co.—a few years ago, when the Germans in competition received a check, notwithstanding their varied and somewhat powerful interests located in St. Petersburg, in regard to both the manufacturing and the supply business.

The present opportunity has brought a formidable German combination into the field. There is, for instance, the Siemens-Schuckert Works Co., or its Russian branch, and the A.E.G., or the Russian Union Electricity Co., the former being backed by the leadership of the Deutsche Bank and the latter by the Dresden Bank, the Disconto Gesellschaft, and the National Bank, whilst nothing is as yet known as to the intentions of the Berlin Handels Gesellschaft, although as the one institution generally swims where the other floats, co-operation will, of course, be the order of the day if the present operation is to be brought to a successful issue. The sole and whole object is naturally to prevent competition among the German firms, and if English interests are concerned, they will probably be offered a sop to ensure their support. But the scheme, the financial management of which is in the hands of M. Davidow, who is one of the directors of the St. Petersburg Electric Lighting Co., and who is also associated with the Siemens & Halske Co., is not one easy of solution, and in high financial circles in the Russian capital the prospects of the project being brought to a successful issue, even with an immediate payment of £2,000,000 and of £3,000,000 within a period of four years, are not regarded as of too favourable a character at the present time.

The Imperial Press Conference.

Great interest has been aroused in London by the calling together of the the Imperial Press Conference, as many heads and editors of the Colonial Press have responded to the invitations issued. Time will not permit of the acceptance of many of the invitations to hospitality, and it is well that business will be the main object, so that when the delegates leave Great Britain they will do so with the conviction that their editorial and literary friends in the mother country are alive to the necessity of closer alliance with the vast dominions and possessions of His Majesty, and that all are striving to bind themselves still more closely to the mother country.

The first sitting of the Conference has been fixed for Monday next, June 7th, at which the Earl of Crewe will preside, and the Right Hon. Sydney Buxton, M.P., and the Right Hon. Austen Chamberlain, M.P., will be present. The subject for discussion will be "Cable News Service and Press Inter-Communication." The Right Hon. R. McKenna, M.P., will take the chair at the second day's sitting, when "The Press and the Empire" will be discussed, and on the third day deliberations will be occupied with "Literature and Journalism." The average citizen does not, perhaps, grasp what an expensive matter it is to place before him the latest news from different parts of the globe; nor does he know that a great amount of news, costing thousands of pounds, is never published, but finds its way into the waste-paper basket as being unsuited and uninteresting to the British public. A correspondent in a far distant possession frequently sends local items, which to him are of great interest, but which are not appreciated by the people here, and although newspapers have to pay for them, they cannot discourage him, or perhaps he would refrain from sending matter which would be desirable, for it is never known when a small possession may be brought into prominence by reason of political events, fires, storms, earthquakes, and similar disasters. The Press has to devote the greater part of its energies to happenings of the day, as, in the hurly burly of present-day life, the subjects of last week are forgotten when events of the current week are engaging attention. The public also has not, up to the present moment, sufficiently appreciated news of an Imperial kind unless it has been of a sensational or very important nature, but times are undergoing a change, and there is no doubt that in years to come there will exist a great demand for it, especially when reciprocity throughout the Empire has become an established fact.

The want of a purely British news service has long been felt in His Majesty's dominions, and Lord Milner, at the meeting held at the Mansion House for the purpose of passing a resolution in favour of State-owned cables, stated that during a tour in Canada he found the news from the Motherland was small in quantity, and not that most desired either as to source or meaning. An Imperial Press agency would, no doubt, lead to an improvement, and the public here should be prepared to have a large supply of its news, and it is a matter for close consideration whether a Government should control the supply, either by arrangement with the cable companies, by subsidy, by acquisition, or by the laying of Imperial cables. In any case, the cost of an interchange of Imperial news should be greatly reduced, as at present it practically prohibits its natural flow. If anything in this direction is achieved by the delegates, a great and important step forward will have been made.

MUNICIPAL TRADING AND THE ELECTRIC LIGHTING ACTS (AMENDMENTS) BILL.

By a Borough Electrical Engineer.

The subject of municipal trading in general, and that portion of it relating to the supply and fixing of apparatus on consumers' premises, is now likely to be brought to a definite issue by the amendments made to the new Bill recently before the House of Lords. As the views of those who oppose municipal trading have often been stated in this journal, it may be of interest to the readers of the Electrical Review to hear something from the other side. By this the writer means that the amendment to Clause 16 of the Amendment Bill, reversing its object, and the arguments brought forward in support of that amendment, are open to criticism. Indeed, this is (in the writer's view) so much the case, that there is good cause to be thankful that there is a House of Commons to revise the inconsidered action of the Lords. This is rather a reversal of the usually considered relation of the two Houses; but, none the less, the writer hopes to show that the Commons ought to exercise this revising function for once.

In the first place, the object of Clause 16 of the Bill was to enable those local authorities who obtained provisional orders some time ago, without wiring powers, to exercise borrowing powers for free wiring and the like, and to confirm their position for undertaking the work of wiring and fitting without the expense of a second application to Parliament. It is well known that many orders have been granted with such powers, and, further, that the larger municipalities have usually obtained very wide privileges in this direction under omnibus Acts. It will be interesting to hear if the new Bill will cancel powers previously obtained; if not, an interesting situation will be created, and if so, the Bill will certainly be thrown out in the Commons.

In considering the arguments advanced with the object of preventing municipal wiring, it must be remembered that all companies working under provisional orders have full wiring powers, and the new Bill, as amended, does not propose to touch them. For this reason the objection that municipal undertakers must not themselves do wiring because wiring inspectors should not be allowed to test work carried out by their employers, is not capable of being applied to municipal as distinct from company undertakers, because municipal and companies' inspectors are in just the same position. To enforce the argument it would have to be shown that municipal inspectors were less honest than those of a company. There may be valid objections to inspectors being

employed by any undertakers (whether municipal or company) carrying out wiring work, but these are easily met by existing provisions for the appointment of independent electrical inspectors. The E.C.A. would do well to take up this matter, and the writer for one would support them.

The other argument used in support of the amendment is, at first sight, a strong one. It is stated that it is unfair for a contractor, who is a ratepayer, to have to meet competition on the part of the municipality he supports through the rates. We will now examine this objection in detail, and see what it is worth in £ s. d., apart from sentiment. It is fair to assume one wiring contractor to every £50,000 rateable value, and to say that such a contractor is on the average rated at £50. The general district rate may amount to 5s. in the £, so our contractor pays £12 10s. per annum for all the public services, including police, roads, sewerage, parks, baths and the municipal electrical undertaking. If this undertaking pays its way, he pays nothing whatever towards it, so the argument must then be ruled out. If it does not pay, it is not likely to take more than a 3d. rate per annum. This means a contribution of 12s. 6d. per annum from the contractor towards the whole undertaking. Now the wiring department usually pays, but it cannot very well cost more than a 1d. rate (if it did the general body of ratepayers would be up in arms). This 1d. rate would mean 4s. 2d. per annum. We can, therefore, say that this poor wiring contractor's grievance, as a ratepayer is usually nil, and is at the outside a matter of 4s. 2d. per annum. Truly, a great matter to cause such a stir. It would appear, therefore, that no cause has been shown why a municipal undertaking should have imposed upon it the handicap of a penalty clause preventing it from exercising powers which every company undertaking may exercise, as long as it is legal for local authorities to engage in trading undertakings. Up to the present, as far as politics are concerned, local authorities are not only permitted, but are encouraged, to undertake the supply of water, gas and electricity, and to fix pipes, wires and fittings in connection with them. If the objection to municipalities carrying out wiring were anything but political, then company undertakers would be included in the first argument, and, further, an agitation would be set on foot by electrical contractors against municipal gas undertakings on account of the ratepayers' argument. What a splendid cry—Should electrical contractors pay rates to support a gas undertaking which is trying to ruin them ! ! Similar objections can be, and are, made continually without effect in the many cases where the policy of the community falls foul of the interests or views of an individual. It is, in fact, the argument of the "Passive Resister."

The wording of the amended clause shows want of care, and would have effects far beyond those intended by its sponsors. As the clause stands, a local authority may not fix, repair or remove lamps, meters or electric lines, except through a contractor (if there is a local ironmonger hanging out the electrician's sign). According to this, we municipal engineers must dismiss our meter staff, and entrust the care of our meters to the tender mercies of a contractor. Further, we must employ a contractor to fix a lamp and to lay a service main, and we must not lay small mains extensions by direct labour. This will not matter very much in a large town—a lucky contractor will, no doubt, be able to equip a depôt and keep men idle and ready for this work, for a consideration, without costing the ratepayers more than 25 per cent. in excess of the existing charges. This is a good thing—for the contractor. In a small town, however, the "standing charges" of this depôt would be out of all proportion to the work to be carried out, and the only alternative is to pay travelling expenses for men and material whenever a small job has to be done. Surely this is an absurdity and was not intended by those responsible for the amendment. Further, it is clear that the municipality may not even repair mains, &c. If the Bill should pass, what would happen in a small town with a dead short on the mains, while a contractor competent to do the work was being hunted up?

It is, indeed, fortunate that the House of Commons has not yet been abolished !

In conclusion, it may be of interest to outline the arrangements introduced by the writer to deal with the question of municipal trading apart from the supply of electricity.

Some three years ago, owing to the lack of really competent local talent, the work of wiring and canvassing for new consumers was not being properly carried out. Many consumers wished the department to do their work, and wanted to know why they could not look to us as they did to the gas people before they adopted electricity. Bad work was also being done by outside contractors, who had no permanent interest in the district, and the undertaking was being damaged. The only local contractor was an ironmonger. In consequence of this, our mains staff was allowed to carry out wiring work. Any work executed by the department is on a day work basis, and no binding estimate is given. If a consumer wants a quotation, we refer him to the contractors.

It is interesting to note that since this was commenced, two real electrical contractors have actually come into the district, and the ironmonger no longer describes himself as an electrical engineer. Now it is strange that these two firms should voluntarily open if municipal wiring were of necessity destructive to fair trading. We have found the department most useful in pushing new lamps and in dealing with motive power questions. The contractors gladly leave to us both matters; the first because of the risk, and the second because manufacturers quote the same prices for motors to consumers as to contractors. It is outside the writer's province to discuss this last point in detail, but it does seem very strange that private enterprise is so unfair. Perhaps the E.C.A. will introduce a measure through their friends to deal with this glaring case of unfair competition.

Free wiring is now being carried out on the following lines:—Any local contractor obtaining a consumer, quotes the engineer for the work, and the engineer puts his own department in competition. If the municipal department quotes appreciably less, the contractor is notified, and we reserve the option to do the work ourselves, paying the contractor 1s. per point to cover his canvassing expenses if a settlement is not arrived at. It has not yet been necessary to carry out this provision in even one case. The fact that we reserve the right keeps prices within reasonable limits. We have given no contract—as that would mean one of the two firms closing up. We try to get consumers ourselves, and then, of course, we do the wiring also; this keeps the contractors alive to the need for canvassing.

These arrangements seem to give satisfaction to all parties concerned, including consumers, contractors, and corporation, so it is clearly not essential to prohibit municipal wiring.

PROCEEDINGS OF INSTITUTIONS.

The Theory and Application of Motor-Converters.

By H. S. Hallo.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, May 6th*, 1909.)

It is claimed for the "motor-converter" that this machine combines the good points of both the other systems, whilst it avoids their defects. It is self-starting, yet runs synchronously when up to speed—the synchronising force being so strong that it is almost impossible for the machine to fall out of step. The characteristics of the D.C. side may be adapted to any ordinary requirements; its voltage may be regulated by adjusting the shunt resistance, and it can further be arranged as a three-wire generator, when it will automatically deal with very large out-of-balance currents. There is no possibility of reversal of polarity as with the rotary converter. The efficiency is substantially higher than that of a motor-generator of the same output, and is nearly equal to that of a rotary with its transformers. It is reversible, and even when supplying current to modern induction motors its regulation is excellent. The first cost is less than that of a motor-generator, and when a large voltage variation is required the motor-converter works out considerably cheaper even than the rotary, alternating-current boosters being necessary with the latter machines in such circumstances. Furthermore, the motor-converter takes up considerably less floor space than either of the former types of converting plant.

Under these conditions one cannot wonder that the motor-converter has made such rapid headway, and that by this time almost two hundred converters, with an aggregate capacity of over 80,000 KW., have been installed.

The motor-converter consists of an ordinary induction motor with wound rotor and a continuous-current machine, rigidly coupled, and arranged with either two or three bearings.

Fig. 1 shows the diagram of connections of a motor-converter in its simplest form. The stator winding is shown as a star-connected three-phase winding, the currents in which set up a rotating magnetic field, revolving with a speed depending upon the number of poles for which the stator is wound. This rotating field induces E.M.F.'s in the rotor windings, which are connected to corresponding points of the D.C. armature.

To make the connections clearer the rotor winding in diagram fig. 1 is shown with nine phases, although the majority of converters have been built with 12 phases. Three of the phases are connected to a suitable three-phase starter through slip rings. The excitation of the field coils is effected in the same way as with an ordinary D.C. generator.

For the sake of simplicity, it may be assumed that the machines have the same number of poles (in the case shown, two poles) and are running at a speed corresponding to half the frequency of the primary circuit. In other words, the rotor is running with 50 per cent. slip, and the rotating field set up by the primary currents induces in the rotor windings a series of E.M.F.'s, which have half the frequency of the primary circuit. Since the number of poles of the D.C. machine is assumed to be equal to that of the induction motor and the armature is rotating at a speed corresponding to half the frequency of the supply circuit, it is obvious that the E.M.F.'s induced in the armature windings have also half the

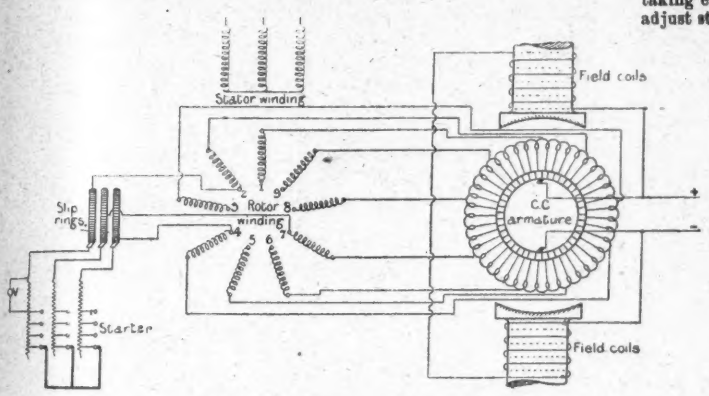

FIG. 1.

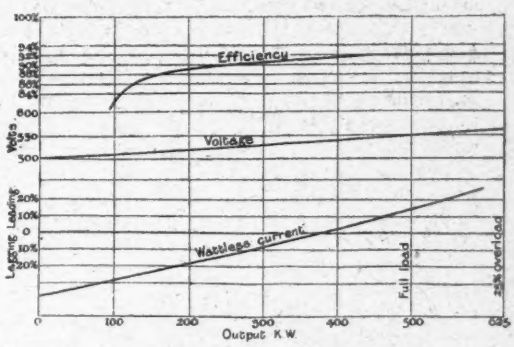

FIG. 2.

frequency of the primary circuit. For this reason it is possible to connect the rotor and armature windings together—provided they are wound with a suitable number of turns—when their E.M.F.'s are equal and in phase, and when this is done the speed remains constant and the two machines connected in tandem behave as a single synchronous machine. This will at once be realised when we study the influence of the rotor currents upon the magnetic field of the D.C. machine. Naturally, in order that the E.M.F.'s induced in rotor and armature winding shall balance each other, the connections between them have to be made so that the rotating field set up by the rotor currents, when flowing through the armature, revolves in the opposite direction to the shaft. That is to say, this rotating field is motionless as long as the speed keeps constant, and it is the action between this field and the one set up by the magnet winding of the D.C. machine which keeps the machine in synchronism, in exactly the same manner as in an ordinary synchronous motor. A variation in speed means a relative displacement of the two aforementioned fields, and this sets up synchronising currents just as in a synchronous motor, the only difference being that the large number of phases in the motor-converter accounts for an extra strong synchronising force.

As the motor rotates at a speed corresponding to half the primary frequency, half the electrical energy supplied to the stator will be converted into mechanical energy and transmitted by means of the shaft to the D.C. machine, whilst the other half of the energy supplied is transferred through the rotor winding to the armature winding in the form of electrical energy. Thus, the induction motor operates half as motor and half as transformer, whilst the D.C. machine operates half as ordinary dynamo and half as rotary converter. As the rating of the motor depends on the speed of the rotating field and not on that of the rotor, the motor is theoretically half as large as though with the given number of revolutions it had to convert the *whole* of the energy led in into mechanical energy. The converter runs at a speed corresponding to half the primary frequency, which is more advantageous with regard to commutation; consequently it is made of smaller proportions than an ordinary D.C. generator or converter for the same output and primary frequency.

When the numbers of poles are different the converter set will not run at a speed corresponding to half the frequency of the supply circuit, but the speed must necessarily be inversely proportional to the *sum* of the number of poles of both machines.

Thus, $n = 60\,c/(p_a + p_c)$, where n = revolutions per minute; c = periods per second; p_a = number of pairs of poles of motor; p_c = number of pairs of poles of dynamo.

Expressing $p_a + p_c$ as p, we can say generally: The induction motor converts p_a/p of the total supplied energy into mechanical energy, whereas the proportion p_c/p is transferred through the rotor winding to the direct-current armature.

In starting from the A.C. side the alternating current—high or low-tension—is supplied direct to the stator winding (see fig. 1) and induces currents in the phase windings of the rotor. At first only three of the nine or twelve-phase windings on the rotor are utilised. These are connected, as shown, through slip-rings and an external resistance to a neutral point. The external resistance is non-inductive, and is gradually cut out as the speed of the machine increases. The other ends of these three-phase windings are permanently connected to the converter armature winding. The direct-current side, of course, is disconnected from the bus-bars and arranged for self-excitation. It will be seen that the machine now starts up as an ordinary induction motor. Meantime, the continuous-current end is building up its field. When the machine approaches synchronous speed, the E.M.F.'s induced in rotor and armature will alternately be in opposition and conjunction, and consequently the current flowing in the starter will alternately be small and large, causing the needle of the voltmeter, which is connected across the starter resistance, to swing slowly over the scale. The periodicity of the oscillations of this needle will gradually decrease, until at last it will remain at rest near the zero-point, indicating that the machine is running synchronously. The starter can be now be short-circuited, and afterwards the slip-rings. This last operation brings all phase windings of the rotor into use.

In practice it will be found necessary to insert resistance in the shunt circuit in order to bring the machine up to speed without taking excessive currents from the supply mains. It is possible to adjust starter and shunt resistance so that no regulation whatever is required during the starting period, the attendant simply waiting for the moment to short-circuit the starter and put in the short-circuiter. The single voltmeter, connected as shown in the diagram, constitutes the whole of the synchronising apparatus required. The

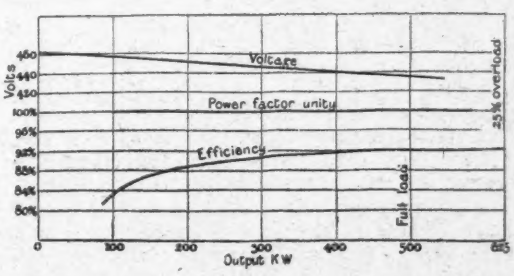

FIG. 3.

starting current is usually about 30 per cent. of the full-load current.

In the case of a single-phase converter it is, of course, necessary to put an auxiliary winding on the stator to produce a starting torque.

The motor-converter can also be started up from the direct-current side, in which case an ordinary D.C. starter and standard synchronising gear for the high-tension side is required.

The ratio k between the output the machine is capable of giving as converter and as ordinary direct-current machine is not without interest. Whereas for the three-phase rotary the factor k is only 1·33, it is for the six-phase rotary 1·93, this being a gain of not less than 45 per cent. With a twelve-phase rotary the gain would be 65 per cent., but the complication of 12 slip rings renders this impracticable. With a motor-converter, however, there is no objection to this large number of phases. The extra advantages gained by the motor-converter are now at once evident. When we compare, for instance, the six-phase rotary converter with 30 per cent. wattless current and the twelve-phase motor-converter under the same conditions, and with $p_c = 0{\cdot}6\,p$, we find that the factor k is the same for both; that is, all the advantages gained by the application of the motor-converter principle in the way of increased regulation, greater stability in running, &c., do not mean any additional copper losses in the armature winding, in spite of the fact that the direct-current side only works partly as a rotary.

As a rule the number of poles for A.C. and D.C. side will be equal, or will only differ by 2.

The introduction of commutating poles gives the designer a still

freer hand, and renders the commutation sparkless with fixed brush position up to heavy overloads, independent of the direction of the current (generating or motoring on direct-current end).

When motor-converters are used for lighting, they may be shunt or compound-wound according to requirements. Shunt machines have about 5 per cent. drop from no load to full load and approximately unity power factor at all loads, as shown in fig. 3, representing the characteristics obtained on a 500-KW. set.

The efficiency, especially at low loads, is remarkably high (in this case almost 86 per cent. at quarter load), and the characteristic curves of the machine indicate the possibility of an excellent regulation by the shunt rheostat, the power factor being well maintained within a wide range of regulation.

Motor-converters for traction service will preferably automatically compound from 500 to 550 volts. The characteristics of a 500-KW. traction converter are shown in fig. 2; the power factor is unity at about three-quarter load, and the wattless current here changes from lagging to leading, which has a favourable effect on the voltage regulation of the alternators. This feature is of special value where the central station supplies both traction and lighting systems, the primary voltage remaining steady in spite of the fluctuating load on the traction converters. The machine can be fitted with commutating poles, so that they can withstand severe momentary overloads without sparking, and the freedom from liability to reversal of polarity on short circuit is of great advantage in traction installations.

Sometimes it is required that a motor-converter shall be capable of supplying either a traction system at 500 to 550 volts, or a lighting system at, say, 420 to 460 volts. Owing to the great flexibility of the direct-current voltage, it is possible to build converters for the above extreme range of voltage; and, as a matter of fact, several such machines with a voltage regulation of as much as 30 per cent. are in successful operation. In order, however, to improve

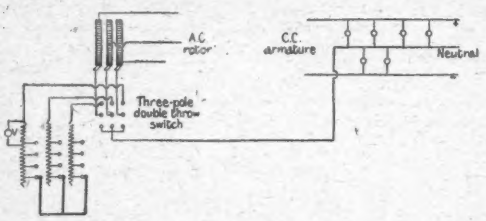

FIG. 4.

the power factor in such a case, it is advisable to use a synchronous booster in series with the rotor winding. With this arrangement unity power factor is obtained at all voltages, and the efficiency at the higher voltage is improved, the main machine acting more as converter and less as generator than otherwise would be the case. Of course, the booster need only be designed to add or subtract *half* the voltage regulation.

Motor-converters can also be used inverted. The increase of speed on inductive load is comparatively small, and does not necessitate the use of special exciters, as is the case with rotaries. The inherent regulation is excellent, the usual drop of the alternating-current voltage being 3 to 5 per cent. with unity power factor, and 12 to 15 per cent. with power factor 0·8. If voltage regulation on the alternating-current side is required it is necessary to use the synchronous booster, unless the converter always runs in parallel with one or more synchronous machines which can supply the wattless currents and maintain the frequency.

The motor-converter can further be used for three-wire supply; it is then connected as shown in fig. 4. It will be seen that the outer mains are connected as usual to the positive and negative terminals, while the middle wire is connected to the star-point of the rotor windings, and may be earthed. When large out-of-balance currents are to be dealt with, it is necessary, in order not to overload the brushgear of the slip rings, to use a three-pole change-over switch, as indicated in the drawing (fig. 4). When the switch is down the three slip rings are short-circuited and connected to the middle wire, so that all brushes on the three slip rings are called upon to carry the out-of-balance current. When the switch is in the other position the slip rings are no longer short-circuited, but connected to the A.C. starter; the switch must be in this position during starting-up.

A motor-converter, thus connected up, automatically balances the current, and the voltage difference between the two halves usually does not exceed 1 per cent. of the voltage between the outers, with an out-of-balance current of as much as 50 per cent. of the full-load current. With 20 per cent. out-of-balance current the voltage difference would be well under ½ per cent., and it is thus clear that the balance is excellent and more than sufficient for all ordinary requirements. If, however, it should be necessary to keep the voltage of the two sides of the system absolutely equal, or even raise the voltage of the heavier loaded half to compensate for the extra drop on that side in feeders and distributing cables, a booster must be put in circuit. Such a booster is series wound, and can be driven by the extended converter-shaft.

Reference has already been made to the possibility of providing a motor-converter with commutating poles.

Such windings are generally fixed on either the positive or negative side of the network; it is, however, obvious that this arrangement cannot be satisfactory when out-of-balance currents are taken from the machine, since the excitation of the commutating poles will not then correspond to the total load on the machine.

The proper excitation can easily be obtained by dividing up the commutating-pole circuit, and by fixing the windings alternately in the positive and negative mains. When that is done, the commutation will be just as good as with machines operating on an ordinary two-wire system.

The discussion was opened by DR. E. ROSENBERG, who said that the author had omitted to state that half of his machine was a rotary converter, and that it had to be about 25 per cent. bigger than the plain rotary for the same output. The Great Western motor-converters were rather large for their output: and it appeared that it was necessary to use a booster with the motor-converter if used on both lighting and traction loads. It was quite easy to design a rotary converter for large voltage variation without a booster, by adding tappings on the transformer and using suitable transformers.

MR. B. M. JENKIN referred to the satisfactory performance of the Great Western Railway Co.'s motor-converters. One reason for their use was that, in addition to supplying the railway, they could be used reversed from the sub-station batteries for supplying the alternating lighting system at Paddington, in case of failure of the Park Royal supply. The converters were used instead of motor-generators, and took less space; they could be started from either end, and gave unity power factor and a high efficiency through all loads with a fluctuating load the latter was important. He had tested the machine as to reversibility, and had broken the D.C. field to observe the effect when the machine ran up to synchronous speed, with satisfactory results. As the result of tests of one of their sub-stations, they had arrived at an efficiency for the converters alone of 82 per cent. without the battery, and 89 per cent. with it. With the battery in use the machine load varied from 38 per cent. to 116 per cent., and without it from nothing to 32 per cent. overload. The overall efficiency of the sub-station with battery in use was 75 per cent., and without it 82 per cent., which latter figure compared with the motor-generator sub-station efficiency of 75 per cent. mentioned by Mr. Rider.

MR. ROGER SMITH (G.W. Railway Co.) commented on the advantage of being able to obtain a leading current with the motor-converter; in some of the G.W. sub-stations it was always leading. Under normal conditions they had a 98 per cent. power factor, and were able to keep a steady bus-bar pressure at the power station. The overload capacity of the motor-converter was an excellent feature; during the exhibition last year, a whole sub-station would be overloaded 60 per cent. for a short period, until the battery booster overtook the load. An 11-days' test of the Shepherd's Bush sub-station showed an average daily input of 15,500 KW.; an average daily input and output of battery of 1,730 KW. and 1,630 KW. respectively; the loss in booster and battery was 5 per cent.; the daily machine load factor was 56½ per cent., and the daily machine efficiency 83 per cent. The latter figure was considerably lower than the 89 per cent. mentioned by Mr. Jenkin, but at that sub-station the battery had 1,000 KW. capacity, while at the other it was only of 500 KW. capacity. The commercial efficiencies (A.C. input to D.C. output) in both cases were practically 79 per cent., so that it did not pay to put in the large battery for efficiency only. He had no wish to change the motor-converters for any other type of plant.

MR. A. H. SEABROOK could not agree that there was any trouble in running rotary converters on 50-period circuits. He had three rotary converter sub-stations on the West Ham 50-period system, and one man looked after them all. The starting was quite simple, and the reversal of polarity had not been a cause of trouble. When long hours were run (day and night), it would not pay to put in a motor-converter or motor-generator as a gift, owing to the better efficiency of the rotary converter.

MR. FRANK BAILEY said his early experience had induced him to leave rotary converters for motor-generators, and at Bankside last year they had dealt with about 4¾ million units in their machines and got an overall efficiency of 77 per cent.

MR. J. S. PECK thought it must be admitted that the high-frequency rotary converter was a satisfactory machine, and its higher efficiency was in its favour. He disagreed with many of the author's remarks; starting up was not so simple as stated. By adding reactance in the transformer circuit or choke coils outside, it was possible to obtain any voltage regulation on the rotary that could be obtained on the motor-converter, also similar efficiency curves. The rotary had an advantage, as it did not carry extra high pressures, also it was always possible to have a spare transformer. He thought 6,000 volts was a limiting pressure for the stator windings of motor-converters, and then transformers would be required.

MR. HALLO, in replying, said his reference to the rotary converter as unsatisfactory was only in cases of 50 or higher period circuits. He thought the use of transformer tappings had been condemned, but in any case, stator tappings could also be made on the motor-converter, although he would not advocate it. As regarded the possibility of breakdown in high-voltage stator windings, there had been no trouble during the past three years, and his firm would build 10,000-volt stators if required. Practically the motor-converter was not more than 1 per cent. less efficient than the rotary, with its transformers. Some figures which he had obtained from the Manchester Corporation motor-converters, under running conditions, the machines being built for a 30 per cent. voltage regulation, gave for the 250-KW. sets, efficiencies of 89 per cent. at full load, and 85·5 per cent. at quarter load, these comparing with 250-KW. motor-generators having efficiencies 85·5-86·5 per cent. at full, and 74-75 per cent. at quarter load. A 500-KW. motor-generator gave an efficiency at full load of 91·5 per cent.; at half load, 91 per cent.; and at quarter load, 87·5 per cent. These results were better even than those given in his paper.

SEVENTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

The objects of this Congress are well known, and are comprehensively indicated in the title. The meeting serves as a stepping-stone between the purely scientific aspect of applied chemistry and the finished process as it is in actual practice. Embracing as it does the wide field of applied chemistry with its numerous kindred offshoots, its importance cannot be too highly valued. In England especially the necessity becomes more urgent every year for a joining of forces between the pure scientists and the manufacturers. The first and foremost object of the Congress is to fill up this breach. To this end, in addition to the numerous papers presented, there is a well-organised social programme, the importance of which can hardly be over-estimated.

The Congress was opened officially on Thursday, May 27th, with the preliminaries usual to such meetings, but the real business in hand commenced the next day. On account of the wide and varied interests involved, the subject matter was divided up into various groups, of which Section X dealt with the electrochemical industry. In this section the following papers were presented on Friday morning :—

"Résumé of Work on the Electrometallurgy of Iron and Steel," by F. A. Fitzgerald.
"The Lash Steel Process," by F. A. Fitzgerald.
"Etat actuel de l'Electrosiderurgie," by M. Clausel de Coussergues.
"Electric Steel Furnaces for Iron and Steel," by C. A. Keller.
"Le Ferromagnetisme et l'étude des Métaux et Alliages," by P. Weiss.
"Sur le traitement de la Wulfenite pour Ferromolybdène à Basse Teneur en Carbone," by G. Gin.
"Sur la Décarburation des Ferroalliages," by G. Gin.
"Sur la Préparation du Ferrovanadium par Electrolyse du trioxide dissous dans le Fluovanadate de Calcium," by G. Gin.
"Note sur la fabrication du Vanadium Silicié," by G. Gin.
"Etude du Traitement industriel de la Vanadinite pour la production de l'Acide Vanadique," by G. Gin.
"Combinaisons du Silicium avec le Molybdène, le Tungstène, et l'Uranium," by E. Defargs.
"Relative Efficiency of the Arc and Resistance Furnace for the Manufacture of Calcium Carbide," by S. A. Tucker, W. A. Alexander and H. K. Hudson.
"Calcium Carbide," by C. A. Hanson.
"Ueber grosse Electrische Oefen," by R. Taussig.

It is unfortunate that many of the authors were unable to attend on the first day, and as a consequence many valuable discussions were missed. Many of the papers were presented in abstract, which partly compensated for this loss. In the first item on the programme Mr. Fitzgerald read a *résumé* of the work on electrometallurgy presented at the May meeting of the American Electrochemical Society. The chief interest in this lay in the most recent attempt to produce pig-iron directly from its ores in the electric furnace. This work is now being carried on in California on a fairly large scale. In this region magnetite containing 70 per cent. of iron can be obtained cheaply side by side with almost pure limestone. Charcoal is also cheap, which immediately places the process in a very favourable position. The type of furnace used is somwhat novel. This consists of the usual shaft for the ore, equipped with a suitable preheater. The electrodes are inserted at the bottom, not in the shaft, but in a saucer-like well, where the metal is reduced. The cost of ore is from $23 to $25 per ton. The cost of reducing this to iron and shipping to San Francisco amounts to an additional $18. In all, however, a good margin of profit is left, and it is probable that further developments will be made in the future. A second paper also was presented by Mr. Fitzgerald, dealing with the production of steel by the Lash process. This is the outcome of several years' experimental work by Horace W. Lash, with the object of producing open-hearth steel from a mixture of pig-iron and ore. The process has been developed further, and a tilting furnace introduced for smelting purposes. The charge is composed of ore, coke and lime, together with a small percentage of granulated pig-iron. Fifty tons of steel were made in this manner, and the process is now being developed on an industrial basis.

Papers 3, 4 and 5 were neither read nor presented in abstract, which was unfortunate, as the number of members present was fairly considerable. The next paper of electrochemical interest was in the form of a motion placed before the meeting by Mr. Mavie.

In this it was stated that the study of relationships between the composition or the constitution of bodies and their physical and chemical properties, and the investigation of the laws which bind the various properties of one substance to another, perhaps constitute the chief problems of physical chemistry. It is important to aid towards development the insufficient knowledge that we possess up to now in this region, and to render easier the search for numerical values necessary to the comparisons that are suggested by purely theoretical speculations, and from which it is hoped to gain some advantage. At the present time very few numerical tables are available, and an investigator has only one resource, that is, to search laboriously in the various original treatises in publication. The object of the proposal was to form an international committee for the methodical classing of values acquired up to a certain date ; and secondly, the publication of other results obtained annually. For this purpose a committee representing England, France, Germany, and Italy was formed, and the discussion was left for the Monday morning meeting. It may be stated here that the proposal was adopted unanimously, and in addition a fresh motion was put to the meeting, in which it was suggested that the committee should take in hand the systematising of physical chemical notation.

The remaining papers were not read, but abstracts of them were available. Of these the only one of electrochemical interest was No. 12 by Mr. S. A. Tucker, who has made a comparison of the relative efficiencies of the arc and resistance furnaces for the manufacture of calcium carbide. On the scale of the experiments the resistance furnace was superior to the arc. With the arc furnace the best results were 1,170 watt-hours per 100 grammes of pure carbide, while with the resistance furnace the same quality of carbide was obtained with 544 watt-hours. Information was also given with reference to the best proportions of lime and coke in the two types of furnace.

In addition to the above a very interesting paper was read before the Section for applied organic chemistry by G. Koller, who described a method for utilising electrolytic chlorine. It is a well-known fact that large quantities of electrolytic chlorine are produced by many of the more recent electrochemical processes. In many cases no commercial outlet has been found for this, and various proposals have been suggested for its utilisation. Of these one of the most feasible is the production of solvent liquids formed by allowing the gas to react chemically with acetylene. In this manner two allied processes benefit. At the present time practically all anhydrous materials used for extracting oil, fats, resins and similar substances are inflammable, and many are highly explosive. Elaborate precautions are necessary therefore to prevent dangerous outbreaks of fire. Many restrictions are imposed by authorities, transport companies and insurance companies, which make it impossible in some cases to work many industries on anything like a profitable scale. The chief feature of these chlorine compounds of acetylene is that they are non-combustible and non-explosive solvents with a wide range of boiling points. Their use ensures absolute safety and combines the advantages of lower freight rates with a total absence of vexatious restrictions. This subject was received with great interest. In the discussion that followed, it was objected that all these chlorine compounds are more or less narcotic in their action on animal life. This is perfectly true, but the property under discussion is not a very active one, and the danger arising therefrom is not as great as that from the average patent medicine. In all the papers read during these meetings the interest was well maintained, and in many cases lively discussions followed. In no case, however, was anything of a sensational nature brought forward.

After a somewhat quiet day on Friday, interest was restimulated by Saturday's programme for the electrochemical section, which is given below :—

Section X.—Electrochemistry and Physical Chemistry.

Presidents for the day: E. R. Taylor, M. Bodenstein and Prof. Armstrong.

"National and International Conservation of Water Power," by E. R. Taylor.
"Ueber die Umlagerung der Cyanamidsalze in Cyanide," by G. Bredig.

"Combination of Nitric Oxide and Oxygen," by M. Bodenstein
"Sur la Transformation Electrolytique de l'Azote Ammoniacal en Azote Nitrique," by Brochet Boiteau et E. Pannani.
"Observations on the absorption by Iron of Carbon from Carbon Monoxide," by C. F. Burgess.
"Applications des Reactions comprenant un Gaz et des Solides," by C. Matignon.
"Applicazioni della Forza centrifuga alle Miscele gassose," by C. Mazza.

Combined Session with Sections I, II, IIIa, IVa and VII.

"Oxidation of Atmospheric Nitrogen, with Experimental Demonstration," by Hofrath Prof. Bernthsen (Badische Anilin-und Soda-Fabrik).
"Industrien des Kalkstickstoffs und verwandter Verfahren," by N. Caro.
"The Fixation of Atmospheric Nitrogen," by C. Weiss.

The first paper was presented by Mr. Taylor, who gave a very interesting lecture on his subject, and aroused considerable interest. In the end, it was proposed that a special day should be devoted to the subject of the paper at the next International Conference. During the discourse, the author stated that in New York State there is at the present time 618,688 H.P. of water-power developed, and that with proper conservation 1,500,000 H.P. is possible. On the same basis the water-power capacity of the United States is not less than 150,000,000 H.P. In the above estimate the storage capacity of small brooks is not taken into account. It was stated that the annual stream flow for Continental U.S.A. is approximately 70,000,000,000,000 cb. ft., of which less than 1 per cent. is restrained and utilised for municipal community supply and relative purposes, less than 2 per cent. for irrigation, 5 per cent. for navigation and 5 per cent. for the production of power. From 85 to 95 per cent. of the total volume of water is wasted in floods. The amount of power available at a cost comparable to that of steam is estimated at 37,000,000 H.P., which is greater than the entire mechanical power in use. The direct damage done by floods has increased since 1900 from $45,000,000 to $238,000,000. The soil matter annually carried into the lowest rivers and harbours is 783,000,000 tons. This not only impairs the productivity of the upland farms, but also greatly impedes navigation. A broad plan of waterways improvement ought to be adopted for the extending of the uses of water. A capital illustration of the waste of water-power was given: a small brook was dammed simply by means of stones from the surrounding fields, and a small canal made to lead water to an adjoining shop, where 25 H.P. was developed, this being sufficient for the purpose. On the same stream there were 89 similar small mills, but not another utilised the power so easily accessible. In this case alone the waste of power was 2,200 H.P. In the numerous illustrations the author showed several views of cheap and permanent dams under construction. These for the most part were suitable for small factory owners. The paper was one of considerable importance and worthy of very careful study.

(To be continued.)

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Engineer's Dept. v. Accountant's Dept.

With great humility I take up my pen to reply, if I can, to the illuminating article of "Interested" in your issue of May 28th. All accountants will gather round and learn, for the book and system—though he modestly says he does not suggest that better arrangements could not be made—bear evidence of a wet towel and many nights of long and unwearied thought for the good of those poor fellows in the accountant's dept. But why are the invoices entered in the "bought" ledger before they are passed on to the storekeeper for the purpose of checking the quantities, weights, sizes, &c.? Is it because the accountant's dept. know by past experience that if they don't enter them, and take the risk of their being in order, it is likely to be the last they will see of them after they have got into the engineer's dept.? But no, that cannot be the reason, for he says "next day they are returned to the office"—how prompt!—and after the charges are checked they are passed to the engineer for signature.

When so passed, observe, ye ignorant accountants, they are entered in the Dr. side of the ledger as though being paid. Of course the works office staff will know all about it—he says they do—but I was always taught that for every debit there should be a credit, and yet in the system of book-keeping inaugurated by our teacher, the accounts are entered on the Dr. side of the Creditors account *before* they are entered into the credit side of the cash book. Perhaps if, at the next Committee meeting, they are referred back for reconsideration before payment, he scratches the entry out or pins a slip of paper in the ledger. Please let us know, "Interested," we are willing to learn. These remarks are not made with a view to criticise the system; we are only seeking information. Does the invoice come in a stamped addressed envelope, or is it delivered? Is the book bound in red basil or in full calf?

Once they leave the works the accounts are considered to be to all intents and purposes paid, and inquiries are in a written reply referred to the accountant's department. With what almost Satanic glee, one would imagine. But why could not the inquiry be sent to the accountant's department to let *them* reply and inform the creditor what he wanted to know? It would save the creditor writing again and incidentally a penny stamp or two. But, of course, being a borough council that does not matter—it would be false economy, and would not show up as they deserve that dreadful accountant's department.

Turning to the receipts, the system is quite different and most refreshing. The accounts cards are kept in drawers possessing locking arrangements so that no cards can be abstracted by unauthorised persons, and at the end of each month or quarter they are sent to the accountant's department—still locked, one would presume, and delivered with great ceremony to the head accountant. But the accountant's department are not all bad—"any payment made at the works is forwarded to the accountant direct without any record being made whatever by the engineering staff." We breathe again. Such trust. Such magnanimity.

From these remarks we are to gather that the electricity department carries out the technical part, and the accountancy the book-keeping. But why? "The works office staff possess a sufficient smattering of engineering together with a *general* knowledge of accountancy work." They are surely in their wrong place, and should be in charge of both departments. Whilst the accounts department make "howlers," they know all the differences between "nominal candle power" and "nominal capital," between "transforming" and "journalising."

But why this article and also why this reply? There need be no friction between the engineer's and accountant's departments. Surely, their interests are mutual and their employers are the same? A healthy rivalry there may be, but why should one department be "versus" another?

Of course, no person is infallible, but the "juice works" staff are not always the department that "lay low and think," especially when they read such a prejudiced article as that written by "Interested," full of information though it may be—of deeply-thought-out information.

Accountant.

The Reliability of Condensers: An Offer.

In your leading reference to Mr. Mordey's paper on the use of condensers in heavy electrical engineering, you say that the paper touches on a debatable question—namely, "the reliability of any condenser for this class of use." This reference on your part is, of course, quite natural and commendable, seeing that condensers have not been used to anything like the extent to which their electrical advantages would entitle them.

We could, of course, give you a list of important installations which have been carried out, and in which the Moscicki type of condenser has for years been permanently under

current, and we only mention in this connection that the number of batteries of condensers thus installed exceeds 1,425 (which means a matter of at least 16,000 single tubes), not to speak of the many thousands which are in use for purposes of wireless telegraphy, the pressures ranging from 5,000 to 60,000 volts.

We are, however, going further; and, in order to prove that the Moscicki condenser at any rate is a thorough engineering piece of apparatus, we hereby make an offer to submit a 10,000-volt condenser to any firm or any engineer who desires to test the condenser under working conditions—that is to say, by placing it across the full voltage for any length of time.

The demand for these condensers has increased so remarkably that we are now making arrangements for their manufacture in this country.

Isenthal & Co.

London, W., *May 28th*, 1909.

Mercury Motor-Meters.

With reference to the correspondence now running on the above subject, I think I can offer an explanation for a part of the phenomena at least. "Strebor," in his first letter, stated that the meters registered satisfactorily on circuit until about 10 or 20 units were reached; might this not be the result of the tendency of mercury motor-meter manufacturers latterly to reduce the size of the mercury chamber, as it will be noticed that nearly all the recent types of these meters have a much smaller mercury bath capacity than was hitherto used? My explanation is that when the meters are first installed the mercury is evenly distributed in the chamber; that is easily seen by removing the screw of the mercury inlet, but after the meters have been in use for some time, there is rather a peculiar effect noticeable, that is, when the screw is removed the mercury runs over the top of the outlet and escapes. I think this goes to prove that owing to the small mercury bath, the mercury works its way on to the top of the float, and also rises in the neck which surrounds the armature spindle; this movement of the mercury which appears to be slow, but nevertheless sure, would naturally have the effect of putting a weight on the float, impeding it, and in the course of time causing stoppage.

This is the only explanation which seems to fit the case; I did not enter this correspondence sooner, as I am unable to give a satisfactory explanation of all the points raised, but as far as corroborating what has been stated by "Strebor" and "Mercurio," I can do so without any hesitation, as I have experienced exactly the same difficulties.

Beacon.

The Editors' comment on my letter of May 17th is gratifying as an assurance that the correspondence is not instigated by the maker of a type other than mercury meters, but I regret that neither "Strebor" nor "Mercurio" has responded to my invitation to direct correspondence.

If mercury meters really behave in such a deceitful manner as to start with 0·05 in the test room, and refuse to start with less than 0·4 on circuit, surely the type would have been condemned long ago. There is no particular behaviour to explain really. Meters of all types have been known to stop on full load, but such isolated faults cannot be attributed to a particular type.

R. H. Schofield.

Hollinwood, *May 29th*, 1909.

E.M.F. in a Dead Underground Cable.

In the act of sleeving a joint on a length of three-core ·075 sq. in. E.H.T. paper-insulated, lead-covered and yarn protected cable, one of our jointers had a rather remarkable experience the other day.

Finding him making use of the usual rubber-insulating mat required for live cable work, I asked what he wanted it for seeing that the cable was dead, and was rather sceptical of the explanation offered that he had just had a severe electrical shock. No argument of mine would convince him that he was mistaken, and I began to seek about for an explanation.

The cable was not only absolutely dead, but did not come near a live cable at any point along its entire length of over two miles. Further, the lead sheathing was completely and entirely insulated from earth, the only bare point being where he was at work. A thunderstorm had, however, just passed over the district, and on questioning the jointer he told me that immediately after the shock he had heard a peal of thunder. The local papers recorded lightning having torn up a field some 10 miles distant, and, judging from the actual time given, this must have been coincident with the above. Whether they had any connection with each other, however, is dubious.

In the process of sleeving the joint the man had been at work some 15 to 20 minutes tapering the sleeve to the lead of the cable, and during this time he was holding the former in his hand. There was thus direct metallic contact between the sleeve and the lead sheathing, but the only contact between the sheathing and earth was through the jointer's body.

Due to the somewhat exceptional circumstances of the case, I thought it might be worth while recording, and if any of your readers have had a similar experience, it would be interesting to know what is their explanation of the occurrence.

Enquirer.

Mining Switchgear.

The letter on page 876 of your current issue again brings up the most important question of safety switchgear in mines, and while agreeing entirely with Mr. Rand's remarks on the so-called "gas-tight" switches, I would suggest that the prohibitive cost of a really gas-tight switch, together with the danger of inferior manufacture, is sufficient reason for turning our attention to what may be termed *flame proof* switches.

By the term flame proof the writer means a switch in which no attempt is made to prevent the mine gases entering or even igniting inside the switch casing, the one object being to cool the ignited gases during their passage from the interior of the switch casing to the outside atmosphere, so that there can be no possible chance of an ignition outside the casing due to a flash at the switch contacts.

The method that I would suggest is to construct a switch on the same principle as the Davey safety lamp—that is, an ironclad switch with small ventilation windows in the casing, these windows being made of several layers of fine iron wire gauze, also at the junction of the lid with the base and where the switch spindle runs through the casing, a riband of similar gauze should be run.

The question that remains to be answered is whether a sudden ignition inside the switch box will force the hot gas outside too quickly for the wire gauze windows to absorb the heat, but I have little doubt that, by experiment, the relative dimensions of the windows, thickness of the gauze and cubic capacity of the switch casing could be so designed as to produce an absolutely reliable switch.

It would possibly be found necessary to provide the switch casing with a baffle plate behind the windows so as to protect the gauze from being burned; this would be a very slight expense, as the baffle plates could be made in the casting of the switch cover.

One certain advantage of such design would be that the danger of any explosive force occurring inside the switch casing would be entirely eliminated, owing to the ventilation windows giving immediate egress to the gases, and the mechanical design of the switch could consequently be made much lighter.

The recent disasters at the West Stanley and Wingate Collieries have brought forth many serious charges against the design and manufacture of the gear at present in use. While admitting that there is no doubt room for much improvement in this respect, I would unhesitatingly say that the chief blame lies with the colliery management rather than with the manufacturer.

It has been my experience within the last two years to enter the workings of a large number of collieries in Northumberland and Durham in which electrical gear is installed,

and I will say that, with hardly an exception, the general wiring and supervision of the electrical plant is of the worst possible order. In many instances the wires are simply bunched together with a piece of cord, and slung over a nail driven in the nearest prop, quite regardless of position or damp. In like manner the switches and motor-starters are often placed in the most absurd positions, and after having been once installed are simply left to drop to pieces before being repaired—everybody keeping as far away as possible. A switch in a mine is like the proverbial electricity meter under a butcher's bench—any mains man will catch my meaning.

The safe operation of electrical plant in collieries lies chiefly with the Home Office and the colliery management, and until the Home Office are more stringent in their regulations and inspections of mines, and the colliery management supply highly skilled supervision, we cannot hope for any greater feeling of security.

W. S. Burge.

Dundee, *May 29th*, 1909.

The Electrical Industry and the "Daily Express."

I have read your leading article under the above title with great interest, and, I must add, with considerable amusement, for surely there was never a more clear case of the Pot calling the Kettle black! You find fault with the *Express* for drawing conclusions from figures relating to one section of the electrical industry, and then you proceed to refute these conclusions by quoting figures for another section, in which the volume of trade is much smaller! Why not examine the figures for the industry as a whole? These can be compared for the years 1903 and 1907 from the tables given in your paper, and are as follows:—

	Imports.	*Exports.*
1903.—Electrical goods and apparatus	£876,000	£2,486,000
Electrical machinery	555,000	437,000
Total for the year 1903	£1,431,000	£2,923,000
1907.—Electrical goods and apparatus	£1,247,650	£2,469,927
Electrical machinery	603,000	996,000
Total for the year 1907	£1,850,650	£3,465,927
Percentage increase in four years	29 per cent.	18½ per cent.

These results speak for themselves, and show up clearly one of the causes of unemployment in this country. Why should these increasing quantities of the manufactured products of cheap foreign labour be allowed to enter this country without bearing their share of the heavy taxation borne by the home products with which they compete?

Enquirer.

[Our correspondent has only half learnt his lesson yet, or he would never speak of "cheap foreign labour" when discussing protection. Tariff Reform, says the *Express*, means work for all and *higher* wages, not "cheap foreign labour!"

"Enquirer" will find the answer to his question in one of the 48 favourable replies to the *Express* inquiry forms, which were sent to 188 out of 2,000 manufacturing firms. "As regards the contracting department of our business, however, the chances are that the imposition of a tariff would adversely affect us. The cheaper class of small parts and accessories used in an electric light installation are largely made abroad, and we think that were a duty imposed on these imported goods, some would be deterred from having the electric light installed owing to its increased cost."

"Enquirer" should not overlook the fact that there is far more labour employed in the erection of accessories than in their manufacture, and he would do more harm than good to labour by a tariff. But we do not wish to be drawn into a general discussion on the question of Protection *v.* Free Trade, as our article was concerned only with the remarkable figure-juggling of the *Express*. Our figures and arguments have not been replied to, except by abuse, which, as the *Express* admits, is an acknowledgment of defeat.—Eds. E.R.]

Oil Engines for Use in Sub-stations.

Mr. Pfeiffer's proposals for the use of oil engines in sub-stations will not, I feel sure, meet with the assent of the majority of central station engineers who have to run a central station in conjunction with sub-stations.

The proposals put forward are really too radical in their nature to cause them to be looked upon with favour. It is quite too alarming to think of the tremendous changes that would be involved by decentralising the main stations, and breaking the links between the sub-station and the main station. If the oil engine is as economical as claimed, let it, by all means, be put in at the central station, but don't break the links between the main station and the sub-stations.

It has hitherto been an accepted principle the world over, that the greater the amount of plant that can be centralised in one station, the lower will be the fixed charges for wages and supervision.

When to this is added the lower capital cost per KW. of the larger generating plant, a further advantage is obtained.

It is also a fact that the smaller the proportion which the cost of fuel bears to the other charges making up the cost at the sub-station, the greater does the saving become that is effected by centralisation under the above two items.

The cost of the sub-station plant is so low, by comparison with the main plant, that it can be thrown in, with still a considerable advantage in favour of centralisation. This sub-station plant, moreover, being all operated from the sub-station switchboard, attendance on same is reduced to a minimum, and wage charges are correspondingly low, even on sub-stations very much smaller than Mr. Pfeiffer has considered. Then again, the cost of the high-tension feeders between the main station and the sub-stations will, in most large towns, be found to be only of the order of £2 per KW. instead of the £8 taken by Mr. Pfeiffer.

If accumulators are introduced in the sub-stations, several further advantages are gained: (1) The generating plant at the sub-station can be used to give 30 to 40 per cent. more output; (2) the wages and other fixed charges consequent upon not putting down that extra plant are in large measure saved; (3) A standby *instantaneously* available for the generating station and for each of the sub-stations is provided.

When these advantages are tacked on to those of centralisation, it will be seen how much we are asked to give up by the employment of oil engines in sub-stations; let alone the poor overload capacity of the oil engine, which is a most serious disadvantage when used under such conditions.

A. M. Taylor.

King's Heath, *May 23rd*, 1909.

Municipal Trading: Unfair Competition.

In reference to your comment on my letter of May 21st in regard to the above, in which you say "Does 'Post Office' maintain that this is the only subject for which Post Office employés can compete with technical teachers? Do they never by any chance teach telephony and the general principles of electricity and magnetism and of electrical engineering?" In reply to this, I would state that there are 25 staff engineers, and of these three only are teachers, and the subjects they teach are only telegraphy and telephony as practised by the Post Office; general telephony and the general principles of electricity and magnetism and of electrical engineering are not taught by them. Such information as is necessary in order to enable students to compete in the Telegraphy and Telephony Examinations of the City and Guilds, *i.e.*, a knowledge of galvanometers, shunts, condensers, &c., has to be obtained from general teachers of electrical science, and not from Post Office staff engineers.

Post Office.

Belgium.—Under the title La Société Belge Siemens et Halske, a Belgian branch of the well-known German company of that name has just been formed in Brussels. The new concern has acquired works at Leval-Trahegnies.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Shock-Proof Hand Lamp.

Some short time ago we referred to the novel shock-proof hand lamp which the General Electric Co., of Queen Victoria Street, recently placed on the market. Its effectiveness is due to its being constructed throughout of non-conducting material; the lamp guard, as we pointed out before, is surprisingly strong despite its being made of non-metallic material. The company has still further improved the lamp by adding a rubber cord grip to prevent damage to the entering cable, and a leather hand loop for easy carrying.

Moreover, the fibre lamp guard is now attached by a bayonet catch with a simple locking device, and there is no metallic part whatever penetrating from the outside of the handle or guard to the interior.

Fig. 1.—G.E. Co.'s Safety Hand Lamp.

The company claims that the design ensures absolute immunity from shock, and that it meets the spirit as well as the letter of the Home Office regulations.

Among its advantages are light weight, simplicity, and the fact that no third wire is required. We think the lamp will appeal to those in search of a really handy portable lamp, and doubtless the company will be glad to demonstrate its quality to those interested.

Double Revolution Drum Type Starters.

Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne, have recently put on the market a combined starter and regulator for variable-speed motors, which entirely overcomes the troubles due to the use of separate starters and regulating rheostats, and which is as simple a piece of apparatus as one could well wish for. Externally the apparatus resembles the firm's well-known drum type starters, and the internal arrangement is also similar, except that a regulating device and change-over switch have been added.

In operation, the handle is brought to the starting position, and held there until the motor starts, after which the resistance is cut out in the usual way, and the second revolution commenced. The starting resistance is now, of course, out of use, and consequently can be short-circuited; this is exactly what the change-over switch does, at the same time open-circuiting the short-circuit which has hitherto existed between the terminals of the shunt regulating resistance.

Further rotation of the handle now cuts the regulating resistance into circuit step by step, until the second revolution is completed, when the motor is running at its top speed.

During the whole of this operation the motor is amply protected by an overload and no-voltage circuit-breaker, which is an integral part of the starter and is entirely out of the control of the operator.

It will thus be seen that the starting and regulating operation is an exceedingly simple one, and as there is only one handle to operate, chances of mistakes are entirely eliminated.

Further particulars can be obtained on application to the makers.

Westinghouse Arcs at Selfridge's.

The Selfridge building stands, as all the world now knows, at the western end of Oxford street, and consists of four floors above ground and two below. Its frontage extends from Duke Street on the east towards Orchard Street on the west.

Long before its completion, Mr. Selfridge let the world of lamp-makers know that he would be wanting arc lamps to light it. The specification included the following amongst other conditions:—305 lamps in all, including 19 spares, with three different amperages: 77 of 7·5 amperes, 223 of 6 amperes, and 5 of 5 amperes.

Fifteen of the chief lamp manufacturers responded to the call for the 305 lamps, which had to be up and burning on the opening day. The business was secured by the British Westinghouse Co., the lamps being installed and put into service on March 15th.

The Selfridge lamps are all of the Westinghouse enclosed differential type, having one shunt and one series coil, with self-contained resistances, and are suited for burning two in series, the voltage being 240 direct current. All the lamps burn for 60—65 hours without recarboning, and ample ventilation is provided. Steady burning is their chief feature; 67 of them are of the single-enclosed class with conical covers finished in white enamel and

Fig. 2.—Westinghouse Arcs at Selfridge's.

having pine-shaped opal globes, the 7·5-ampere lamps in this class being fitted with carbons of 13 mm. and the six-ampere with carbons of 12 mm. diameter; 238 are of the double-enclosed class having ornamental cases of Corinthian pillar design finished in black and silver, and fitted with clear-glass inner globes and special opal outers designed to ensure effective diffusion of light. These lamps are fitted with carbons of 13, 12 and 11 mm. diameter respectively according to amperage.

"Sanco" Petrol-Electric Sets.

In the accompanying illustration (fig. 3) we show one of the "Sanco" petrol engine and dynamo sets which are made by the Wilson-Wolf Engineering Co., Ltd., of Thornton Road, Bradford, in

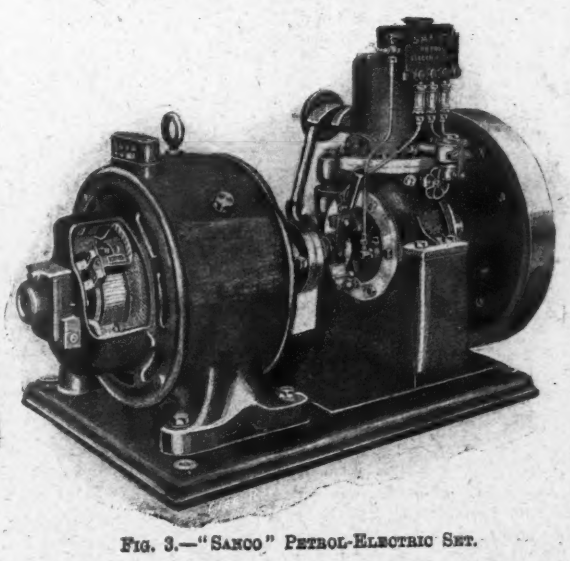

Fig. 3.—"Sanco" Petrol-Electric Set.

various sizes, for from 50 16-c.p. lamps up to 12 b.h.p. The sets are claimed to be very compact; and as the 50-light set takes one-

third of a gallon of petrol per hour, it is estimated that, with petrol at 9d. per gallon, the cost per hour would be 3d. A two-gallon tank has been standardised, holding enough petrol to supply the engine of the smaller set for six hours. In a catalogue recently issued by the firm some notes are given on the use of these sets for country-house installations. Prices are given for plants for 50, 65, 100 and 130 lights, and a specification of the different parts of the installation is set out.

"Midget" Accumulator Switch.

MESSRS. NALDER BROS. & THOMPSON, LTD., of 34, Queen Street, E.C., are placing on the market the "Midget" N.C.S. automatic accumulator switch, for circuits up to 80 volts and currents up to 50 amperes. This switch is specially suitable for use in connection with "wire lamp" low-voltage installations. It is differential in its action, connecting the cells into the charging circuit as soon as

FIG. 4.—"MIDGET" BATTERY SWITCH.

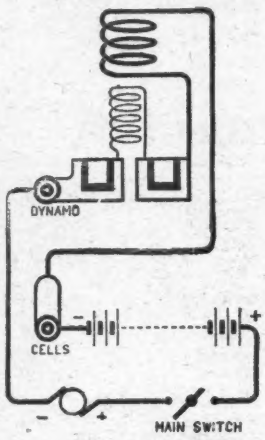

FIG. 5.—DIAGRAM OF CONNECTIONS.

the voltage of the dynamo rises sufficientiy above that of the cells, and is independent of their actual voltage. It cuts out the cells directly the charging current falls to zero, so that there is no sparking at the mercury cups; and it is impossible for the cells to discharge through the dynamo with this switch in circuit, as it combines with it the functions of a reverse-current cut-out. The overall size of the switch is 5 in. wide × 8½ in. high. Its external appearance is shown in fig. 4, and the connections in fig. 5.

"Guardian" Patent Hand Lamp.

The accompanying illustration (fig. 6) shows a neat and simple hand lamp with aluminium parabolic reflector, which is designed with a view to securing complete safety to the user. The lamp-holder and cap, and the key-switch, are completely enclosed in a

FIG. 6.—"GUARDIAN" HAND LAMP.

strong wooden handle, which also encloses the flexible. The device is especially intended for use in hospitals, and we are informed that 60 have been supplied to the Manchester Infirmary; but there are many other cases in which an inspection lamp of this type would be found very convenient. It is also made with a strong wire guard for use as an ordinary portable hand lamp. MESSRS. WARD & GOLDSTONE, Sampson Works, Salford, are the patentees and manufacturers.

New B.T.-H. Motors and Dynamos.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, are introducing an entirely new line of D.C. motors and generators embodying the latest improvements. Special attention has been given to the permanent exclusion of moisture from the insulating materials,

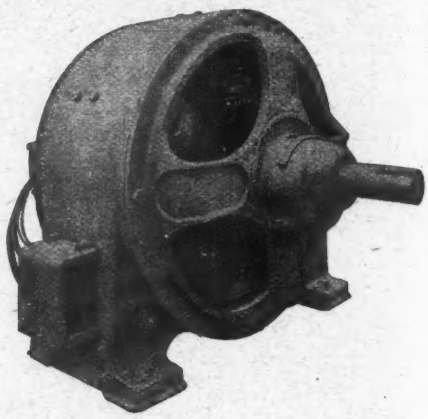

FIG. 7.—B.T.-H. "PROTECTED" MOTOR, TYPE D H.

which are treated, after drying the coils, with a special moisture-proof compound. The coils are tested with 1,500 volts A.C. for 60 seconds while the machine is hot. The armatures have slotted cores, form-wound, and well provided with ventilating channels; the magnet frames are of cast-iron, with laminated steel poles, which can be removed with the field spools without displacement of the armature. The bearings are self-oiling and self-aligning, and are lined with white metal; the end shields can be turned through 90° or 180° to allow the motor to be mounted on the wall or ceiling. All the machines will stand full load for six hours, with

FIG. 8.—D H MOTOR, WITH EXPANDED METAL COVERS.

a temperature rise not exceeding 40° C., and 25 per cent. overload for one hour, or 50 per cent. momentarily, without injury. Expanded metal or perforated metal covers can be supplied, with little effect on the rating; when enclosed ventilating covers are provided, which completely protect the interior of the machine, the armature is equipped with a fan which draws air in under the commutator-end shield and discharges it at the pulley end, without permitting leakage of water into the machine. This arrangement permits of the normal rating. Flame-proof covers are also made, and the machines can be supplied in a variety of styles, which are described in List No. 210. The accompanying figures 7 and 8 show some of the features of this series of machines.

New Electrical Regulator.

THE ELECTRICAL REGULATORS AND ECONOMISERS, LTD., of 16B, Cumberland Street, Liverpool, are introducing an entirely new type of electrical resistance regulator (Martin's patent), which gives perfectly uniform variation of resistance without the use of contacts, liquids or wires. The resisting material is of an elastic nature, contained in small cylinders lined with insulation and fitted with pistons; these elements can be assembled in series or parallel to suit requirements. The variation of resistance is effected by compressing the material with the aid of a screw or other device. It is claimed that steady working over long periods, great range of control, simplicity, reliability and very low first cost are amongst the advantages of this regulator, the standard pattern of which is applicable to any voltage from 4 to 250 volts without alteration. The pattern illustrated herewith (fig. 9) is intended for controlling a lamp, and this it does effectually, enabling any desired degree of illumination to be obtained from full to dull red, even with a 5-C.P. lamp on 200 volts, as we have proved with a sample.

It is also suitable, for example, for regulating the speed of a desk fan from dead slow to full speed. The device can be used on both A.C. and D.C. circuits, and the material is not liable to injury through overloading. A number of regulators have already been supplied to

Fig. 9.—Martin's Patent Regulator (Cover Removed).

various laboratories of the highest standing, being similar in effect but far superior to the well-known carbon-plate resistances, and ideal for laboratory work. From what we have seen of the regulator, we have no doubt that it will come into extensive use and find many and various applications.

PARLIAMENTARY.

London County Council Tramways Bill.

(*Continued from page* 878.)

On May 25th the Committee continued the consideration of the proposals for reconstructing the tramways in Tooley Street, Deptford Lower Road, and Woolwich Lower Road. The Council also proposed to make an extension of the line at Tooley Street 250 yards towards London Bridge, and also to continue the line at the Deptford end for a short distance.

Mr. Fitzmaurice, engineer to the Council, in reply to Mr. Harper, who appeared for a number of frontagers in Tooley Street, said that there was no intention at present of connecting the line at Tooley Street with the tramways in Southwark Street.

Mr. A. L. C. Fell (chief officer, L.C.C. tramways) said that he considered the proposed extension at Tooley Street would be a very valuable connecting link to London Bridge. For several years past the Tooley Street line had shown a considerable loss in the working. Last year there was a loss of £8,022. He estimated, however, that when the line was electrified that loss would be reduced by £2,600. He anticipated a loss of £5,897 in the first year's working of the electrified tramways.

Mr. Fitzmaurice, engineer to the Council, recalled on Wednesday, May 26th, in answer to Mr. Lloyd, K.C., for the Bermondsey Borough Council, who asked that a bridge at Deptford which runs over the East London Railway, and across which the tramways are proposed to be run, should be widened, said that to do so would cost £3,000.

Mr. Shirley Benn, Chairman of the Highways Committee, gave evidence. He said that he did not think the Council would incur a large expenditure in widening the bridge. They proposed to run a double line of trams at Dockhead, where a single track is now running.

The Chairman remarked that he thought the proposal for a double line in such a narrow thoroughfare was dangerous.

Mr. Pollock, K.C., for the L.C.C., intimated that the Committee had the power to say that the line should be a single one.

Replying to the Chairman, Mr. Benn said that if it was the view of the Committee that the Council should contribute £500 towards the widening of the bridge at Deptford, he thought his Council would find the money. This closed the case for the promoters.

A number of witnesses having given evidence on behalf of frontagers, &c., the Committee adjourned.

Watford U.D.C. Bill.—Sir F. Leyland Barrett's Committee of the House of Commons recently considered this Bill, which dealt almost exclusively with water. On the Committee dealing with the financial clauses, the question arose whether in calculating the sum of money that the Council might borrow under the Public Health Acts, sums borrowed in respect of the water or electric light undertakings should be reckoned. Mr. Morten Turner (clerk to the local authority) said the electric light undertaking was remunerative, and he suggested it was hardly fair that money borrowed for remunerative works should be treated in the same way as money to be applied to undertakings not directly remunerative. Replying to the Chairman, witness said they had made a profit on the electric lighting undertaking after paying the contribution to the sinking fund, and their order contained the Bermondsey clause under which they were bound to make both ends meet. They had just come to the end of their first three years' working, and the number of consumers was steadily increasing. The Committee decided that sums borrowed for the electric lighting undertaking should not be calculated.

York Town and Blackwater Gas (Electric Lighting) Bill.—This Bill which was the subject of considerable discussion before the House of Commons Committee on May 25th, was before Lord Onslow's Committee of the House of Lords as an unopposed measure. It was ordered to be reported for third reading.

Batley Extension.—On Thursday last week, Local Government Provisional Order No. 6 was before the Examiner. The Bill confirms the Local Government provisional order for the extension of the boundaries of Batley so as to include part of Soothill, but there is a clause providing that nothing in the article or in the Batley Electric Lighting Order, 1898, as extended and applied to the borough shall prejudicially affect the undertaking or powers of the Yorkshire Electric Power Act, 1901, in relation to the added area.

Dewsbury Extension.—A Local Government provisional order has been introduced to confirm the extension of the borough of Dewsbury so as to include the Ravensthorpe district, the Soothill Nether district, the Thornhill district, and part of Soothill Upper. By Sec. 7 of article 9 it is provided that the electricity undertaking of the Ravensthorpe Council shall be transferred to and vested in the Corporation, and by Clause 9 the Dewsbury Electric Lighting Order, 1891, will apply to the added portions. Nothing, however, shall prejudicially affect the powers of the Yorkshire Electric Power Co. under their Act of 1901.

Preston, Chorley and Horwich Trams.—This Bill came before the Unopposed Committee of the House of Lords on May 25th, and formal evidence having been given in proof of the the preamble, it was ordered to proceed. The Bill provides for an extension of time for the construction of works, &c.

THE NATIONAL PHYSICAL LABORATORY.

The Report of the Laboratory for the year 1908 was recently issued, and, as usual, deals with many matters of interest to electrical men. Intercomparisons between the resistance standards of the Reichsanstalt, the Bureau of Standards and the N.P.L. have been made, and show that the high-resistance coils are of identical value, while the unit coils are in agreement to 1 part in 100,000—a very satisfactory result. The remarkable constancy of the Weston normal cell, even when carried round the world, and the close agreement between such cells made-up here and in the United States (differing only by 2 parts in 100,000) are equally noteworthy features of the Report. A wave-meter has been constructed by Mr. Campbell for the determination of oscillation frequencies in wireless telegraphy. A transformer giving 100,000 volts, for a research on dielectric strength, has been contributed to the equipment by the Engineering Standards Committee, and arrangements have been made for carrying out life tests in incandescent lamps in accordance with the Committee's specification. Considerable attention has been devoted to electric furnace work with excellent results; the efficiency of the platinum resistance furnace has been so far improved that with an internal capacity 50 per cent. greater, the power consumed has been reduced by over 57 per cent., and an entirely new type of furnace in which the heating element is a spiral cut out of a solid carbon tube has been successfully designed by Mr. W. A. Price and Dr. Harker. The new magnetic observatory at Eskdalemuir has been opened, but serious difficulties have been experienced through the entry of damp, and observational work has not yet been commenced.

Measurements classed as "Electrical" numbered 300 in 1908, compared with 254 in 1907; "Electrotechnics," 1,615 against 897; "Photometry" (almost entirely incandescent lamps), 779 against 400. The income for the year increased by £4,813 to £21,872, and the fees for work done from £9,324 to £13,089; the expenditure amounted to £21,343.

In his report on the work of the Physics Department, the Director, Dr. R. T. Glazebrook, says that Dr. Rosa's discovery that shellacked coils vary in resistance with changes of atmospheric humidity has been confirmed; changes have also occurred in manganin coils which cannot be attributed to this cause, but appear to be due to change in structure of the alloy.

The construction and intercomparison of Weston normal cells have been constantly in progress; the effects of agitation, temperature variations, short-circuiting over long periods, charging current from other cells, and exposure to light after setting-up have been investigated, and in every case the Weston cell has exhibited a remarkable immunity from permanent disturbance of E.M.F. Agreement between new cells is generally within one part in 100,000, and cells made in Washington equally agree with N.P.L.

cells—the mean E.M.F. of 19 cells brought from Washington in October differed from the mean of the N.P.L. cells by one part in a million.

Low-resistance shunts for alternating currents, in which the potential leads form sheaths closely fitting the shunt, so as to compensate for self-inductance, have been constructed and found to give excellent results. The large standard of mutual inductance has been completed and brought into use, and a new method has been devised by Mr. Campbell for determining the unit of resistance in absolute measure with the aid of mutual inductance and resistance, which promises to give good results.

The determination of oscillation frequencies in wave telegraphy—the N.P.L. name for wireless telegraphy—has been carried to a high degree of accuracy, the observations ranging from 300,000 to 1,000,000 cycles per second.

The accurate comparison of light standards has received much attention during the year; new apparatus has been constructed, and new methods devised with a view to attaining an accuracy of one part in 1,000—work which entails an enormous amount of labour. The whiteness of the light given by metallic-filament lamps has necessitated the use of standard glow lamps run at a higher efficiency than has been customary, and the B.T.-H. metallised carbon filaments have been employed for this purpose, running at 3·5 and 3·1 watts per candle. A series of higher steps is being organised with the aid of metallic filaments running at still higher efficiencies, tending towards 1·5 watts per candle.

By a modification in the definition of standard humidity, agreement has been arrived at between the British and French units of candle-power without altering the value of the candle.

A very complete system of carrying out life tests on glow lamps in accordance with the Engineering Standards Committee's specification has been devised, and the equipment has been greatly improved.

Accurate methods and new apparatus for testing high-class A.C. instruments have been rendered necessary by the great increase in the demand for such tests; alternating voltage is measured to one part in 10,000 with reflecting voltmeters, current to one part in 1,000 with a Kelvin balance, up to 600 amperes, and power to a higher degree of accuracy with an electrostatic wattmeter. With the aid of transformers, currents up to 2,000 amperes, necessitating the dissipation of 4 KW. in the resistance, can be determined, and it is for this purpose that the water-cooled non-inductive resistances mentioned above have been constructed, ranging from 0·04 to 0·001 ohm.

The Westinghouse 100,000-volt transformer and a special voltmeter connected directly across the high-pressure terminals, have been installed, and a large electrically-heated oven for carrying out disruptive tests at high temperatures has been provided.

The large sizes of some of the D.C. instruments submitted for testing have taxed the capacity of the battery and regulating resistances almost up to their limit; watt-hour meters for 2,000 amperes and 400 to 600 volts, a precision ammeter for 8,000 amperes, and a standard shunt of 6,000 amperes, have been tested. No fewer than 160 primary cells of various makes are under test.

Very valuable work has also been done in the other departments of the Laboratory, to which we are unable to refer in detail here.

A Swedish Radium Enterprise.—It is announced from Stockholm that the preliminary notice has been locally registered for the formation of the Culm Co., which proposes, according to various inventions of Dr. G. Hellsing, to win uranium and radium from the mineral culm and other raw materials, and to dispose of patents and licences. The minimum share capital has been fixed at 700,000 crowns, and the maximum at 2,100,000 crowns. The promoters of the company are Profs. J. G. Andersson, Svante A. Arrhenius and Sten, A. Hj. Sjogren, Dr. G. H. Hellsing and C. U. Waern, the names being said to be apparently a guarantee that the scheme rests upon a scientific basis. Prof. Andersson is the manager of the State authority known as Sweden's Geological Investigation, Prof. Arrhenius is the celebrated physicist and Nobel prize winner, and Prof. Sjogren is the superintendent of the Government Mineralogical Collections and successor to the discoverer of the North-Eastern passage. It appears that Prof. Nordenskjold, Dr. Hellsing and other founders have for several years past investigated the mineral culm, which is a kind of impure pit coal existing in the Alaun schist, for the winning of uranium and oils. After it had been discovered abroad that most minerals embodying uranium also contain radium, the latter has likewise been discovered in culm, which exists in an inexhaustible quantity in the Swedish province of Vastergotland. The promoters of the company have assured themselves of considerable fields in this province, one alone containing 100,000 tons of culm. As a result of previous experiments it has been found, it is stated, that 1 ton yields 4 milligrammes of radium bromide, a combination which is said to be admirable for the market.

Charge of Obtaining under False Pretences.—William Parkinson, an electrician, belonging to Lancaster, was charged at Morecambe. By means of a collecting book he represented that he was receiving subscriptions to assist a man who had lost both arms, and he collected about £5 last week at Morecambe, telling the police that he was an electrician in the employ of the Midland Railway Co., and was handing the money over to the stationmaster at Lancaster. These statements were stated to be untrue, and formed the basis of a charge of false pretences, upon which he has been remanded in custody.

THE IMPORT TRADE OF INDIA.

The tables which have been embodied in the recently issued Blue Book dealing with the trade of British India in recent years, possess a certain amount of interest to the electrical industry, inasmuch as they show the values of the imports from different countries, and therefore the trading position of each. In the course of an explanatory note, it is mentioned that the imports into India are classified as received from the countries whence they were shipped direct to India, and are not credited either to the country of production or to the country of original consignment; and that much of the trade shown as to and from Holland is in reality trade with Germany.

The imports of stores for the account of the Government of India are given separately in the Blue Book, and they may be set forth in the first place. Thus, under the heading of telegraph materials, the tables indicate imports of the value of £101,466 from the United Kingdom in 1907-8, as compared with £185,791 in 1906-7, and the purchases from other countries were £3,359 and £281 in the same years respectively. In the case of instruments and apparatus, the United Kingdom held £112,130 out of the total of £115,985 imported in 1907-8, as contrasted with £93,297 and £94,321 respectively in the preceding year. A similar position is indicated in the case of machinery and millwork obtained for Government account, the total value being £180,371 and £220,634 in the two years, and the British share of it being £173,740 and £219,652 in 1907-8 and 1906-7 respectively. Coming now to the general imports, the Blue Book gives the following details for the past three years:—

	1905-6.	1906-7.	1907-8.
Electrical instruments, apparatus and appliances.—			
From United Kingdom...	£183,178	£296,612	£295,306
„ Belgium	7,750	16,934	6,391
„ Germany	7,949	28,059	13,024
„ United States ...	4,383	27,782	7,482
„ Other countries ...	2,474	2,472	4,987
Total ...	£205,734	£371,859	£327,190
Steam engines and parts; locomotives (excluding those for railways).—			
From United Kingdom...	£12,972	£37,687	£57,810
„ Belgium	Nil	774	3,582
„ Germany	1,315	6,233	7,079
„ Other countries ...	155	Nil	159
Total ...	£14,442	£44,694	£68,710
Steam engines and parts: other sorts.—			
From United Kingdom...	£617,059	£805,136	£817,464
„ Belgium	4,797	8,748	18,225
„ Germany	10,401	1,151	6,206
„ United States ...	13,659	8,227	4,690
„ Ceylon	4,284	3,553	2,203
„ Other countries ...	4,306	2,719	692
Total ...	£654,506	£829,534	£849,480
Electrical machinery.—			
From United Kingdom...	£143,177	£154,265	£155,230
„ Belgium	3,416	6,009	16,087
„ Germany	3,779	6,216	6,276
„ Italy	155	2,847	3,783
„ United States ...	7,448	8,733	14,415
„ Other countries ...	579	2,202	2,296
Total ...	£158,554	£180,272	£198,087
Mining machinery.—			
From United Kingdom...	£48,717	£39,665	£48,493
„ Belgium	306	311	2,740
„ Other countries ...	704	1,434	479
Total ...	£49,727	£41,410	£51,712
Other descriptions of machinery.—			
From United Kingdom...	£664,314	£1,149,668	£1,322,456
„ Austria-Hungary...	1,486	415	1,858
„ Belgium	12,380	5,833	19,171
„ Germany	38,868	34,976	54,347
„ United States ...	22,448	49,591	52,693
„ Ceylon	1,094	1,404	3,404
„ Other countries ...	4,437	4,335	8,239
Total ...	£745,027	£1,246,222	£1,462,168

The value of the imports of materials for the construction of telegraphs, other than those previously mentioned for Government account, is exceedingly small. It amounted to £1,947 in 1907-8, as against £9,898 in 1906-7, and £24 in 1905-6, the United Kingdom being the sole source of supply in each year. The Blue Book is complemented by an appendix giving details of the special import duties in force in India, together with particulars of the general import duties.

BUSINESS NOTES.

Bankruptcy Proceedings.—John Reginald Wiley Middleton and Alfred Ernest Edward Daniels, trading as Middleton & Co., 11a, King Street, Dover, electricians.—The public examination of these debtors was held at the Canterbury Bankruptcy Court on May 27th. Some particulars have already been given in our last issue. The business (said Mr. Middleton) was still being carried on by a money lender under the title of Middleton & Co., and he (Middleton) was still acting for the firm, sometimes giving orders for goods. He quite understood that when the new purchaser took over the business and it was turned into a limited liability company, all the creditors would be paid. Daniels, who is under arrest on a charge of bigamy, and who appeared in Court in the charge of a warder, also gave evidence, and the examination was adjourned until June 24th, the debtors being directed to file full and complete accounts of their receipts and expenditure in connection with various financial transactions.

J. G. S. Cunnington & H. P. Allison (trading as Laing, Wharton & Cunnington, electrical engineers and contractors, 7, Great Newport Street, St. Martin's Lane, W.C.).—At the meeting of creditors referred to by us last week, the assistant Official Receiver (Mr. D. Williams) reported that the debtors had attended before the Examiner in the Official Receiver's department, and it appeared from their statements that Mr. Cunnington commenced business as an electrical engineer in 1894 at Cecil Court, St. Martin's Lane, with a capital of £300, one-third of which was a loan. He traded there as J. S. Cunnington & Co. for six years, and then removed the business to 93, St. Martin's Lane. Two years later he was joined as a partner by a Mr. King Smith, who brought in capital and stock to the extent of £3,000, and also the goodwill of Laing, Wharton & Down, Ltd. That company, of which Mr. King Smith previously acted as manager, had gone into liquidation, and he took over the business from the Receiver. He also paid Mr. Cunnington £500 in consideration of the partnership, and they traded as Laing, Wharton & Cunnington, with an equal division of the profits, until 1903, when there was a dissolution by mutual consent, Mr. Cunnington taking over the liabilities and assets and repaying to Mr. King Smith his £3,000 capital and £500 premium. He continued the business alone until May, 1907, when he entered into partnership with Mr. A. P. Allison, with a view to purchasing the business of the Improved Electric Supplies, Ltd., then in liquidation. The purchase price was £8,250, of which £3,500 was paid in cash to the Receiver who was in possession on behalf of the debenture-holders, the balance being payable by two equal instalments of £2,375 at three and six months respectively, and bearing interest at the rate of 5 per cent. They were sued in respect of the first instalment, but counterclaimed for damages on the ground of misrepresentation; judgment, however, was given against them, and also a subsequent judgment in respect of the final instalment, amounting, in all, with costs, to about £4,000. Under the terms of the partnership agreement with Mr. Allison, Mr. Cunnington was to collect all his outstanding debts and pay the creditors of the 93, St. Martin's Lane business; he was, further, to take into the new business, stock and capital to the extent of £3,000, but he ultimately only provided just over £2,000, whilst Mr. Allison paid in £3,000 cash. Again, the partnership deed provided for an equal division of the profits. The business was then transferred to 7, Great Newport Street, and there continued until the present time, but in consequence of an execution having been levied on behalf of the Receiver of the Improved Electric Supplies, Ltd., in respect of his judgment, the debtors were advised to file their petition. They employed five clerks and 15 workmen in the business. The failure was attributed to the adverse judgment for £4,000 odd, for which the debtors alleged that they had received no consideration. Mr. Allison had stated to the Examiner that under the will of his father, who died 37 years ago, he became entitled on the death of his mother to one-third share of the estate, valued at £2,600. His mother advanced him £2,000, which he paid over to Mr. Cunnington, and she died last October, leaving him under her will entitled to a one-fourth share of her estate, valued at £2,200. He had charged his interest to secure a loan of £1,000, the balance of the capital which he contributed to the firm, and, apart from that charge, he had no separate liabilities.

An incomplete statement of the joint affairs of the debtors had been lodged which showed unsecured liabilities £2,866; fully-secured debts £1,123, those creditors holding securities valued at £1,499; partly secured debts £4,056, the securities being valued at £381; liabilities on bills, £284; and preference claims £37. The amount of ranking liabilities was consequently returned at £6,542, against assets valued at £3,823 less the £37 preferential claims, and the deficiency was estimated at £2,756. There were altogether 190 unsecured creditors; the fully-secured creditors were the bankers who had advanced cash on the security of bills of exchange deposited with them for collection, whilst the partly-secured creditor was the receiver for the Improved Electric Supplies, Ltd., who had a charge over sundry book debts. Upon the application of the creditors, the Official Receiver, when the receiving order was made, appointed Mr. Alfred Page (Josalyne Miles and Blow) chartered accountant, to act as special manager and carry on the business until the election of a trustee. That gentleman had just handed in an account showing that he had received £31 and expended £106, the difference being due to the fact that there were a number of orders in hand which had been executed, but not yet paid for.

Mr. Alfred Harris represented the debtors, and intimated that no proposal could be submitted. Resolutions were accordingly passed, as mentioned last week, for the estate to be administered in bankruptcy by Mr. Page, acting as trustee, with a committee of inspection. The trustees' bond was recommended at £3,000. A resolution was also passed confirming the appointment of Mr. Page as special manager at a remuneration of £5 per week.

The following proofs of debt were tendered:—

	£		£
Armorduct Manufacturing Co.	13	Kara & Co., F.	38
Atkins & Dott	26	Koehler, Spiller & Co.	223
Beckett & Parker	14	Long & Gardiner	98
British Insulated and Helsby Cables	97	Le Carbone	19
Branckmann, A.	103	Marples, Leach & Co.	51
Consolidated Pneumatic Tool Co.	96	Mackie & Co., W.	13
Carless, Capal & Leonard	17	Marsh, Son & Co.	14
Cooper & Co., Ltd., H.	15	Morris Hawkins, Ltd.	19
Callender's Cable Co.	53	Offer, G.	12
Colman, G.	15	Paper, Ltd.	21
D.P. Battery Co.	35	Palmer, Sir W.	29
Evered & Co.	24	Piutte, Scheele & Co.	19
Electrical Co.	59	Pinson & Co.	14
Fuller Elec. Co.	34	Reliance Elec. Wire Co.	15
Geipel & Co., W.	40	Strangeways, J. & J.	62
Galsworthy, Ltd.	24	Snell, A. T.	21
General Electric Co.	47	Snowden, H. J., & Muff, H.	4,077
Hornsby & Sons, R.	70	Standard Cable Co.	122
		Union Elec. Co.	38
		Vorwerck & Sohn	17

Re Lancelot Walter de Grave, electrical engineer, 19, Queen Street, Derby (also carrying on business as a metal worker, under the name of Degrave & Co., and as a motor engineer under the name of Squire & Co.).—The first meeting of creditors was held at Derby on May 29th. The liabilities amounted to £272, and the assets were put down at £187. The bankrupt stated that the cause of failure was bad trade and insufficient capital. He is 36 years of age, and commenced business about 10 years ago as an electrical engineer, with £100 free capital. Three years later he started as a metal worker under the name of Degrave & Co. In August, 1907, he purchased a cycle business for £15, and in January, 1908, he removed the cycle business to his present address, and added motor-car engineering. His takings amounted to about £4 a week. No resolution was passed, and the matter was left in the hands of the Official Receiver.

T. A. Evans, electrical and mechanical engineer and contractor, Swansea.—A first and final dividend of 1s. 3d. is payable on June 10th at Government Buildings, Swansea.

Private Meetings. — Vaughan & Cook, Ltd. (in Liquidation).—With reference to the report appearing in our issue of last week, we have received just as we go to press the following letter:—

"As liquidator of the above company, my attention has been drawn to a paragraph in your issue of May 28th, with reference to a meeting of creditors of the above company.

"While your report is correct in most respects, it omits certain facts which were mentioned by me at the meeting, and, as reported by you, is misleading, particularly with reference to the amounts stated as the trading losses.

"The winding-up of the company is caused chiefly by the retirement of Mr. Cook, and as the business has now been sold, and is again working under the management of Mr. Vaughan, it is considered by him that it would be very detrimental to the business if a list of creditors of the old company were published in your issue of next week, and, under the circumstances, I should be much obliged if you would kindly withhold the same.

"Leonard V. Houseman, *Liquidator*."

We are pleased to publish the above letter, but we regret that we cannot see our way to withhold the list of creditors alluded to in our last issue. The principal creditors are as follows:—

	£		£
Aland & Co.	16	Griffiths & Billingsley	127
Braulik, G.	53	Jones & Co.	54
Buck & Hickman	80	L. & N.W. Railway Co.	15
Bullivant & Co.	15	Marreco & Co.	21
Busse	206	Measures Bros.	34
Chard, G. H., & Co.	19	Munzing, H.	18
Compendium Publishing Co.	16	National Radiator Co.	25
County of London Electric Supply Co.	86	Newton, J. M., & Son	15
Davis, C. J.	19	Potter, F. W. H.	46
Derwent Foundry	21	Senior, T. & W., Co., Ltd.	26
Dicks Asbestos Co.	44	Simmonds, F. H.	33
Electrical Co.	232	Simplex Conduits Co.	35
Falk, Stadelmann & Co.	35	Smith, G.	14
Goslett, A., & Co.	17	Smith & Son	39
General Electric Co.	61	Union Electric Co.	12
Grevener, J. & H.	27	Walsall Hardware Co.	147
		Wolff, J. G., & Co.	18

Marples, Leach & Co., Ltd., electrical engineers, 28, Artillery Lane, London, E.C.—In pursuance of Sec. 188 of the Companies' (Consolidation) Act, 1908, a meeting of the creditors interested in this matter was held on Saturday, May 29th, at the offices of the company, 28, Artillery Lane, E.C. The meeting was called by the joint liquidators, Mr. Geo. Ambach and Mr. R. Clements, the first of whom presided. No proper printed statement of affairs was presented, but Mr. Clements read figures from a balance-sheet of the company prepared as at May 14th last. According to this, the liabilities amounted to £22,979, of which £17,565 was due to trade creditors, and in addition there were debentures for £7,500. There were also contingent liabilities of no less than £18,000, but it was not known what portion of these would rank on the estate for dividend. The assets were set down at £33,257, being made up as follows: Cash in hand, £872; debtors, £10,538 10s.; stock at valuation, £16,611; fixtures, fittings, &c., £1,869; plant and machinery, £689; and investments in Time Ring Spinning Co., £2,677. It was pointed out that, apart from the contingent liabilities, the company showed a large surplus. Arrangements were being made with a well-known German company to take over the assets of the company, and the whole of the claims of the

creditors would then be paid in full. It was not known what portion of the contingent liabilities would rank. Until the liabilities were known the German company could not take over the business as they might be called upon to meet the contingent liabilities, or what portion of them ranked on the estate. The negotiations were still in progress, but it was not to be expected that the purchasers would make themselves responsible for the contingent liabilities. Replying to a question, the liquidator said that the company which proposed to take over the concern was the Bergmann Electrical Co., of Berlin. A creditor said that the Bergmann Co. might buy the assets from the liquidators of the company, and Mr. Clements replied that they might get over the difficulty by way of an assignment, and, in fact, that was what they proposed doing, if it could be done. Numerous questions were then asked regarding the nature of the contingent liabilities. Mr. Clements stated that, some time ago, the company entered into an arrangement with the Time Ring Spinning Co. Under this arrangement the company were to receive an order from the Spinning Co. to carry out a contract amounting to about £18,000, but, in addition, the company were, if necessary, to invest about £15,000. So far, the company had paid £2,500 on the shares they held in the Spinning Co., and a further call of £750 was now due. There were also other minor contingent liabilities, including a claim against them in respect to the sale of certain lamps. The contract regarding the mill was entered into about 12 months ago. The mill was not yet built, but when it was completed the company was to fit it up. A creditor said it was a rank speculation, and not a matter of business, and another creditor expressed the opinion that it was a very hazardous agreement to enter into. Replying to a question the liquidator stated that under the articles of association the directors of the company had the right to invest money in outside concerns. The article dealing with investments was read, and a creditor said that the article only meant the investment of any surplus cash the company might possess. Apparently the company had never had any surplus cash for investment, and the directors had no right to enter into such an agreement. He was of the opinion that the investment in the Spinning Co. was *ultra vires*, and that the directors should be held responsible. Mr. Clements replied that it was a question for counsel to decide. The securing of the contract for £18,000 was conditional on the investment of £15,000, and was a purely business arrangement. It was also stated that the company whose name had been mentioned in connection with the purchase of the concern were by far the largest creditors in the matter. A resolution was proposed approving of the appointment of the present liquidators, but this was opposed by several creditors. A question was asked regarding the debentures, and it was said that they would be taken over by the purchaser of the concern. No receiver had been appointed by the debenture-holders. The last issue of debentures was made on January 25th of the present year, and the balance-sheet showed that the company was then solvent. After a somewhat protracted discussion, it was decided by a large majority to adjourn the meeting for a month, the liquidators being asked in the meantime to obtain further and more definite information regarding the contingent liabilities.

Catalogues and Lists.—MESSRS. MIRRLEES BICKERTON AND DAY, LTD., Hazel Grove, near Stockport.—20-page pamphlet containing an illustrated description of the Mirrlees-Diesel oil engine, with notes regarding cost of running, and also concerning the company.

BRITISH INSULATED & HELSBY CABLES, LTD., Prescot.—New leaflets have just been issued as follows:—P. 96, list of contracts for telephone cables containing 200 pairs and over, recently executed for home and foreign telephone authorities; P. 98, P. 99, P. 100, Prescot joint-boxes; H. 43, Helsby magneto mine exploders and shot-firing cables.

MESSRS. W. SISSON & CO., LTD., Gloucester.—A number of neatly illustrated lists relating to the Sisson patent single-crank enclosed engines for ship and other electric lighting sets, also containing a specifications of their compound double-crank high speed double-acting engine for power, traction and lighting service, and of their open-fronted vertical compound double-crank automatic engine. The lists are in an expanding binder case.

THE SUNBEAM LAMP CO., LTD., Park Road, Gateshead.—Pocket card giving prices of Sunbeam metal and carbon filament lamps; also list "H," describing their silent pattern auto-transformers. A further circular, dated June 1st, gives a list of reduced prices for their tungsten lamps.

MESSRS. ERNEST F. MOY, LTD, Greenland Place, Camden Town, N.W.—Leaflet regarding their type 50 double-pole ironclad switch.

MESSRS. TETLEY & CO., Manchester.—Leaflet briefly particularising and giving prices of accumulator switchboards and automatic accumulator switches.

THE KEY ENGINEERING CO., LTD., London and Manchester.—Illustrated circular describing the "Key" lead-covered wire system of interior wiring (Hill's patent).

MESSRS. SIEMENS BROS. & CO., LTD., Caxton House, S.W.—Pamphlet No. 522, describing their electric revolution counter, with diagrams showing the method of drive from turbines and reciprocating engines respectively.

MESSRS. KRUPKA & JACOBY, 11, Queen Victoria Street, E.C.—List announcing reduced prices of tantalum lamps.

THE SANITAS ELECTRICAL CO., LTD., 61, New Cavendish Street, W.—40-page sectional catalogue devoted entirely to the latest developments in lamps for surgical purposes. These include the latest improved cystoscopes, oesophagoscopes, universal electroscopes, urethroscopes, ophthalmoscopes, head lamps, lamps for examination of the mouth and throat, lamps for direct illumination from the outside, for trans-illumination and for insertion internally to the bladder, stomach, &c. Copies of the list will be sent to anyone interested, together with the firm's full general catalogue (350 pages).

MESSRS. LITHOLITE, LTD., 55, Hackney Grove, London, N.E.—New lists of Litholite handles, bushes, washers, and caps; they are caught in an expanding binder so that later sheets may be included as issued.

MESSRS. BAXENDALE & CO., Miller Street, Manchester.—Twenty-page illustrated price list of electric fans for desk, table, porthole, bracket and other service, also exhaust fans of box and propellor type blades, battery and lamp-holder fans, small electric forge blowers, &c.

Dissolutions and Liquidations.—ELDON ELECTRIC CO., LTD. (in voluntary liquidation).—Mr. A. G. Robson, electrical engineer, 60, Pilgrim Street, Newcastle-on-Tyne, has been appointed liquidator in the place of Mr. W. Sparks resigned.

GENERAL ELECTRIC SIGN AND ENGINEERING CO., LTD.—A meeting of creditors is to be held at 28, Basinghall Street, E.C., on June 10th.

BUENOS AYRES AND BELGRANO ELECTRIC TRAMWAYS CO., LTD.—A meeting is to be held at 52, Moorgate Street, E.C., on June 30th, to hear an account of the winding-up from the liquidators.

JOSEPH RICHMOND & CO., LTD.—June 12th is the last day for receipt of proofs for intended dividend by the liquidator, Mr. R. J. Ward, 2, Clements Inn, Strand, W.C.

THE DE LAVAL IGNITER CO., accumulator experts, Haden Street, Moseley Road, Birmingham.—Messrs. J. M. Dawson and T. Rigg have dissolved partnership.

River Trip.—The members of the LONDON WHOLESALE HARDWARE CLUB, LTD., are arranging a river trip for Saturday, July 10th. Particulars, both of the event and of the club itself, may be obtained from the Secretary, Mr. Reginald Cooper, Royal London House, Finsbury Square, E.C.

Stoker Contracts.—Among recent contracts secured by the UNDERFEED STOKER CO., LTD., for their stokers, are the following:—

Borough of St. Helens electricity department, 2 E.
Borough of Walsall electricity department, 3 E, 4 B 5, and 2 D.
Leyton Urban District Council (repeat order), 16 B 5.
Bromley Electricity Station, Bromley, Kent, 4 B 3.
Metropolitan Borough of Woolwich, 14 B 3, 4 D.
Northampton Electric Light and Power Co., Ltd., 1 E.

Trade Announcements.—MR. G. WÜTHRICH has appointed Messrs. W. B. and J. Bain, 65, Waterloo Street, Glasgow, as his representative in the whole of Scotland for the sale of machinery plant and apparatus manufactured by the Maschinenfabrik, Oerlikon.

MESSRS. FOXCROFT & DUNCAN have formed their business into a limited company under the title Foxcroft & Duncan Engineering Co., Ltd. (1909).

MR. E. E. COY, of 77, St. John's Road, Bootle, Liverpool, has been appointed sole district agent for the Electrical Apparatus Co., Ltd., Battersea (motor starters, controllers, &c.), and for Mr. H. B. Brooks, of Birmingham (dynamos, motors and fans).

MESSRS. TETLEY & CO., of Salford, state that owing to the growth of their London business, they have, for the convenience of customers, opened a London office at 577, Mansion House Chambers, 20, Bucklersbury, E.C., which will be under the management of Mr. Harold C. Hodgson, who formerly acted in the capacity of agent for them. Telephone No. 8,374, Bank; telegrams: "Torquated," London.

"Fluxite."—Fluxite soldering paste has been included in each of the field equipment boxes of the Sappers and Miners in the Indian Army Service Companies.

Exhaust Steam Turbines.—We understand that the BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO., LTD., have for some time past been running a 500-KW. exhaust steam turbo-generator set of their own manufacture in conjunction with the vertical cross-compound reciprocating engine and condensers which supply power to their own shops. They have also secured a number of orders, aggregating over 4,000 KW. for exhaust steam or mixed pressure turbo-generators, complete with condensers and electrical equipment of their own manufacture, for both A.C. and D.C. circuits. These include both Parsons and Rateau type turbines, and are of from 250 to 1,200 KW. capacity. Most of these sets are working in conjunction with the exhaust from reciprocating engines in textile mills and industrial works.

LIGHTING and POWER NOTES.

Aldershot.—The working of the electricity undertaking during the past year has resulted in a profit of £93, which it is proposed to place to reserve.

Bailliebоro (Ireland).—The District Council of this town is making application to the L.G.B. for powers to light the town with electric light in pursuance of Sec. 80 of the Public Health (Ireland) Act, of 1878.

Barking.—Messrs. D. de Pass & Co. are considering the question of using electricity for power purposes at their works at Creeksmouth. In the event of the firm deciding to do this, it will be necessary to increase the plant at the Council works by installing a 200-KW. alternator, and the electrical engineer has been instructed to obtain quotations for the supply of this plant.

Blackburn.—The borough electrical engineer has prepared his annual report in which he observes that the year has been one of depression to the whole of the electricity supply undertakings, municipal and private, and in many instances progress and development have, for the time being, ceased. This he attributes to bad trade, and the more general use of methods of economic illumination. The income for last year was £35,156, the expenditure £18,287, and the gross profit £16,869, compared with £34,761, £17,743 and £17,018 for the previous year. The net profit for the year was £976. During the year 4,212,000 units had been sold, an advance of only 70,000 units, whilst the number of consumers had increased from 1,700 to 2,000. The total connections in equivalent 30-watt lamps reached 175,550, motors totalling a horse-power of 1,216, had been installed, whilst 301 motors owned by the consumers had also been connected.

Brighton.—The result of the past year's working of the Electricity Department is a satisfactory return to profit-earning conditions. It will be recollected that during the three previous years when the undertaking was recovering from the heavy capital expenditure on the new Southwick plant and contingent alterations, there were deficits, and prior to that substantial surpluses were earned. This year 8,037,711 units were sold, an amount only slightly above 1907-8; the revenue, £83,281, was even less than in 1907-8, but the total costs were only £38,038, as compared with £42,417 in 1907-8, and £47,444 in 1906-7. The gross profit of £45,242 sufficed to meet interest and sinking fund charges and leave a balance of £565. Some 333,143 equivalent 8-c.p. lamps and 4,773 consumers are connected, the latter figure being some 250 in excess of the 1907-8 total. The total debt created in respect of the undertaking was £760,998, and provision for redemption of this debt amounted to £213,216.

Brookwood.—The County Council has recommended the substitution of electric lighting for gas in the asylum, and the provision of additional power for this and other purposes, the cost being some £4,000.

Caergwrle (near Wrexham).—A local company has been formed for the purpose of supplying electricity to the village. Electrical energy will be generated at Messrs. Griffith's tool works.

Carlisle.—The accounts of the Corporation electrical undertaking for the year ended March 31st last are the most satisfactory that have been issued, showing a gross profit of £6,851 and a net profit of £2,222. For the year 1907-8 the profit was £235, and £300 would cover the profit for the preceding eight years, in most of which a loss was shown, the aggregate of which would be about £6,000.

Dundee.—The Corporation electricity department reports that the revenue received from the sale of energy last year showed an increase of £2,000, while there was a decrease on the expenditure of £300, the gross profit being £12,047, as against £9,741 in the previous year. After the payment of interest and sinking fund, which this year amounted to £11,868 as against £9,578 last year, there was a balance to be carried forward of £1,256. The estimates for the year provide for an income of £37,867, of which £11,718 will be from the tramways.

Dundalk.—The Urban Council is about to apply for sanction for a loan of £25,000, of which sum £20,000 will be devoted to an electric lighting scheme. The latter provides for a suction gas-driven plant, including three 75-kw. sets, at a total cost of £14,653 for power station, mains, which will be underground in the principal thoroughfares, flame, arc and metallic-filament lamps. The Committee in charge of the scheme recommended the adoption of the scheme of Messrs. Miller, Wilson & Pegg, Belfast, and the scheme has been approved of by Sir A. B. W. Kennedy.

Egypt.—We learn that the new Choubrah central station of the Cairo Electric Railways and Heliopolis Oases Co., Ltd., is now practically completed. The plant, which has a capacity of 10,000 h.p., will not only supply the energy required for the electric railway, and for lighting and tramway purposes in the town of Heliopolis, but also for general uses in the Cairo district.

Farnham.—It is understood that the Farnham Gas Co. will be amongst the applicants for electric lighting powers in the near future.

Gloucester.—The year's working, 1908-9, has resulted in a small profit, which is considered satisfactory, as the previous year's operations resulted in a loss of £1,206. During the year some 4,514 8-c.p. lamps were connected; 1,390,253 units were sold, including 547,308 for lighting and power, 598,366 for traction, 199,716 for public lighting, and 53,863 for the refuse destructor. The income was £12,354, and the expenditure £6,738; interest and sinking-fund charges absorbed the balance except for £10. A considerable saving was made on coal, repairs and maintenance and salaries, the latter due to there being no chief engineer during March, and no chief assistant during February and March.

Gravesend.—The T.C. has given an undertaking to the L.G.B. that in future a separate account will be kept of the expenditure under each loan sanctioned in connection with the electricity undertaking. The L.G.B. had threatened not to further consider the Council's application for a loan of £6,000 unless this undertaking was given.

Hessle.—The Hull T.C. has informed the Hessle U.D.C., which asked the Corporation if it would take over the E.L. Order, that it cannot bear the cost incurred in obtaining the Order or the expenses of the transfer, as the supply of energy would be for the benefit of Hessle ratepayers only, and there would be a slight loss on the undertaking for the first year or so. It has also been intimated that an extension of time for carrying out the Order will be necessary.

Heysham.—The B. of T. has informed the Council that it will not defer the revocation of the 1904 Electric Lighting Order.

India.—According to the *Times of India* of May 1st a licence for the supply of electricity in Rangoon has been granted to the Rangoon Electric Tramway and Supply Co.; it will be called the "Rangoon (Cantonment) Electric Licence, 1909."—*Board of Trade Journal.*

Kingston-on-Thames.—The Maldens and Coombe U.D.C. having asked the T.C. whether it would be prepared to supply energy to the district, and upon what terms and conditions, the T.C. has pointed out that it would be pleased to assist the Council as a neighbouring authority, but before discussing the subject it would be necessary to know who were now the parties having the right to supply electricity, and whether they were desirous of the Corporation affording any such supply.

London.—St. Pancras.—Recently the B.C. proposed to invest some £12,000 of its electricity reserve, in a loan to the electricity department for machinery and plant. The L.C.C. did not agree to this, holding that the long term loans of the department should be repaid at earlier dates with a view to improving the financial position. The Finance Committee of the B.C., however, supports the original proposal to draw from the reserve fund for the extension of plant, &c.

Hammersmith.—The Electricity and Lighting Committee recommends the B.C. to proceed with the conversion of 259 public lamps to electric lighting, in accordance with the scheme approved on April 15th, 1908. Application is to be made to the L.C.C. to sanction a loan of £2,000 for this purpose.

Maidenhead.—A L.G.B. inquiry into the application of the T.C. for a loan of £3,500 for the extension of the electricity works and plant was held on May 25th. There was no opposition.

Maidstone.—The T.C. has decided to convert 158 gas lamps to electric, and the charge per lamp has been reduced from £3 10s. to £3 per annum.

The price of current for the tramways has been reduced to 1½d. per unit.

Nelson.—Mr. Helme, manager of the electricity and tramways undertakings, issued his annual report on April 28th. He mentioned that the department had experienced a decreased revenue from lighting owing to the more general use of metallic-filament lamps, and partially to depression in trade. The net profit was only £36, against an estimated profit of £139, the decreased income from electricity supply to their own cars being approximately £80. The total units sold during the year were: Lighting, 267,464; motive power, 65,188; tramways, 303,006; light railways, 231,926; contract, 21,989—total, 889,573. The total number of units generated was 1,054,511, compared with 1,026,068 in 1908. The result of the year's working on the tramways had been a loss of £819, against an estimated loss of £118, solely due to trade depression.

Newton-in-Makerfield.—The B. of T. has revoked the 1903 electric lighting order.

Plymouth.—The Electricity and Street Lighting Committee has been informed that the assessment of the electricity undertaking has been increased from £2,000 to £4,500.

Reigate.—The L.G.B. has sanctioned a loan of £1,521 in respect of excess expenditure; as to the application for a loan of £2,340 for mains, transformers, services and meters, the Board has informed the T.C. that in view of the very unsatisfactory financial position of the undertaking, and the heavy losses which have been continuously incurred since the works were opened in 1901, it is of opinion that before any further loan is sanctioned, the Council should engage a qualified electrical engineer to thoroughly investigate the working of the undertaking, with the view of ascertaining what steps should be taken to place it on a more satisfactory footing. The Board also objects to the pooling of loans, and requests a discontinuance of the practice. The Council has decided that the chairman, Mr. A. B. Apsted, the town clerk, and the electrical engineer, shall confer with the L.G.B. upon the subject.

Runcorn.—The Castner-Kellner Alkali Co., of Weston Point, has intimated to the Runcorn Council its intention of applying for a prov. order for electric lighting in the area of the rural district council.

Sale (Cheshire).—The U.D.C. has applied to the B. of T. for permission to place overhead E.L. lines along portions of Tatton, School and Northenden Roads.

South Africa.—A Commission has been appointed to inquire into and report on the desirability of the establishment of large electric power companies in the Transvaal and the probable effect of such companies on (*a*) the Witwatersrand gold industry (*b*) the coal industry, (*c*) the Central South African Railways, (*d*) agriculture and irrigation, (*e*) any other industries or trades, (*f*) the employment of labour, and (*g*) the country generally. The Commission will also consider what powers and facilities (if any) should be conferred on such companies by the State, what restric-

tions and conditions should be imposed upon them, and what powers of expropriation should be reserved to the State.

East London.—The T.C. has resolved to spend £13,000 on the equipment of the electric power station which it has just purchased from the Harbour Board.

Klerksdorp (Transvaal).—A special committee of the T.C. has been deputed to go fully into the matter of lighting the town by electricity.

Stevenage.—The B. of T. has informed the U.D.C. that it will defer for a year the question of revoking the E.L. Order. This will be the final extension. The Council has decided to advertise for offers for taking over the order.

Stoke-on-Trent.—The T.C. has decided to ask the local member of Parliament to support the Electric Lighting Acts (Amendment) Bill, relating to wiring and the supply of fittings, &c.

Sunderland.—The annual report of the Corporation electricity department for the year ended March 31st, 1909, was presented to the committee on May 28th. It stated that there were ten power consumers, and 2,515,516 units were sold, a net decrease of 1,829,338 compared with the previous year. One shipyard for which provision had been made took no supply; ordinary consumers had increased from 1,224 to 1,238 and there was a decrease of sales of about 10 per cent. Part of this was due to depression in trade. These consumers had taken 1,888,908 units. For traction purposes 1,770,411 units were sold, a decrease of about 3½ per cent. The report, which is signed by Mr. Alfred S. Blackman, the electrical engineer and manager, concludes:—"With regard to the general situation, and while the heavy falling-off is to be very much regretted, the results of the year's working indisputably demonstrate the financial soundness of the undertaking. With a falling off of revenue to the extent of £10,000 for the year, it has been possible to make a gross profit of over £3,030 more than the year before."

Westhoughton.—At a special meeting of the District Council held on May 25th, it was decided to transfer the E.L. Order to the Lancashire Electric Power Co.

West Ham.—Under an agreement made in 1907 the Leyton Council is paying West Ham for the use of the Dames Road and Forest Road tramways, and for energy used thereon, at 1½d. per car-mile. Owing to the distance of the section from the West Ham generating station, no profit is derived from the sale of the current, and as the Leyton tramways department only pays ¾d. per unit for its consumption above 1,850,000 units per annum, it would be of advantage to Leyton to supply this section itself, an arrangement which is to be acceded to. In 1908 the expenditure on new motors was £3,580, while the income was £1,392, as against £3,965 and £559 respectively in 1907. The estimated expenditure under this head for 1909 is £1,890 and income £2,280. There was a deficit on motors on hire for 1907 of £786; for 1908 £598, and a profit for 1909 of £820. From the time when the Corporation commenced hiring out motors in 1900 up to March, 1908, it was the practice to deliver and fix motors free of charge, and the rents charged were, in many cases, inadequate to cover maintenance, not allowing for depreciation, the idea being to make the profit out of the increased sale of current. This was altered from March, 1908, and no fixing or delivering is now done free, and rents have been raised to a figure covering all charges against them. Up to 1909 the amount spent on motors was £13,198, of which £2,027 has been written off. Application is to be made to the L.G.B. for sanction to borrow £5,000 for mains and services during the ensuing 12 months.

Willesden.—The electrical engineer reports that the change effected last year in part of the Cricklewood area from direct to alternating-current supply has proved satisfactory and economical, and, at his suggestion, the area is to be extended to include roads on the eastern side of Walm Lane. The report of Mr. J. F. C. Snell has been received upon the offer made by the North Metropolitan Electric Power Supply Co. as to the proposed revision in the rates for bulk supply. The document is to be printed, and will then be considered by the Electricity Committee.

Wimbledon.—In response to an inquiry from the Maldens and Coombe U.D.C. as to terms for supply of electricity, the T.C. has offered a supply at 2d. per unit, subject to variation with price of coal, on condition that the U.D.C. meets financial charges on the feeders and agrees as to supply over a period of years.

Worthing.—Mr. M. K. North, M.Inst.C.E., one of the Inspectors of the L.G.B., held an inquiry on Tuesday respecting the application of the T.C. for sanction to an additional loan of £3,900 for electric lighting purposes; £1,600 of the sum required is wanted for two new feeders.

Nine Beck flame arc lamps have been installed in Chapel Road and South Street during the past two months as an experiment, and the Electricity Committee of the T.C. recommends their retention at the cost previously decided upon of £54.

York.—The T.C. has applied for a loan of £550 for a new traction switchboard and alterations to the existing panels.

The electrical engineer is to report upon the cost, &c., of a scheme for the extension of public lighting by electricity on the proposed tramway routes.

TRAMWAY and RAILWAY NOTES.

Merthyr Tydfil.—The B. of T. has granted an extension until May 16th, 1911, to the Merthyr Electric Traction Co. for completing the tramway to Cefn.

Wolverhampton—Cannock Chase.—The Wolverhampton and Cannock Chase Railway Co. has applied to the Light Railway Commissioners for an extension of time for carrying out the Order granted in 1907.

Continental Notes.—Tyrol.—Plans are being prepared in respect of a projected electric railway from Meran, in the Tyrol, up the Vigiljoch.

Germany.—The Mid-German Railway Construction and Operation Co., of Leipzig, has commenced work on the construction of an electric railway between Altenburg and Gera.

Hungary.—A preliminary concession has lately been granted in respect of a projected electric tramway in the town of Zombor.

U.S.A.—Philadelphia.—A great tramway strike is in progress, a few cars only being on the road, each guarded by four policemen. Some 2,000 special policemen have been enrolled in anticipation of disturbances in connection with the strike.

Newcastle.—The Tramways Committee has agreed to recommend that the net profit of £7,557 be added to reserve, bringing that fund up to £62,699.

West Bromwich.—The annual report of the Corporation tramway undertaking states that the total loans raised were £152,397, of which £17,611 had been actually redeemed and extinguished. The full amount of rent chargeable to the Tramways Lessee Companies had been received, viz., £8,606, less income-tax amounting to £430, deducted by the lessees. The net profit on the rental of the tramways for the year was £271, to which must be added the surplus of £66, being the difference between the amount charged to the companies for repairs and maintenance of track and the actual cost of that work to the Corporation. There was thus an amount of £337 available for application to the deficit in the tramway revenue account, which would be thereby reduced to £756, and at the present rate of progress the amount would be liquidated in about two years.

Stalybridge.—From the abstract of the accounts of the Stalybridge, Hyde, Mossley and Dukinfield Tramways Board, it appears that last year there was a deficit of £9,518, as against £10,381, in the previous year. In the electricity department the deficit amounted to £538, which is slightly more than in 1907.

Middlesex.—An agreement is to be entered into with the L.C.C. and the Metropolitan Electric Tramways, Ltd., for the working by the company of the L.C.C. tramways in the Archway Road, between the Archway Tavern and the county boundary at Highgate Archway, for a further period from December 31st, 1908, to December 31st, 1913, at a rental of £2,500 a year. The Light Railways and Tramways Committee has been authorised to expend up to £500 on works connected with cross-over roads and other similar works.

Kirkcaldy.—As a basis of negotiation it is proposed that a single tramway line with three or four turn-outs be laid down to Dysart, and that Kirkcaldy should receive an annual payment of £150 for 10 years towards the cost of maintenance from Dysart. The extension scheme is highly popular.

Bolton.—We understand that arrangements are now being made between the South Lancashire Tramways Co. and the Bolton Corporation for the running of through cars between Bolton and Walkden and Clifton. The Bolton general manager submitted a report to his committee upon the proposed arrangement, and this was approved subject to the T.C. preparing the legal agreement.

Sunderland.—The annual report of the Corporation Tramways Committee, considered at a meeting on May 27th, showed receipts for the past year of £60,224, which were the lowest for more than five years. The net profit on the year's working was £3,723. Of this, £2,640 was given towards the reserve and renewals fund, and the balance was used on works. The reserve and renewals fund now amounts to £30,796; and £71,249 has been set aside for sinking fund.

London.—Hammersmith.—Following on correspondence between the London United Tramways and the B. of T. in regard to the appointment of a referee in the case between the Tramways Co. and the B.C., the latter has decided to inform the B. of T. that it considers the referee should be appointed forthwith, as the Tramway Co.'s recent Bill was rejected, and the appointment would not now prejudice the company's interests.

Glasgow.—The financial year ended on May 31st, and for the 12 months the total traffic revenue is estimated at £889,025, compared with £907,494—or a decrease of £18,469 against the total for the preceding 12 months. The total for 1908-9 is, however, about £2,000 in advance of 1906-7. In connection with the deficiency, it is pointed out that there was an extra day owing to leap year in 1907-8, and the average day's drawings total about £2,500. There is thus a falling-off for the year 1908-9 of practically a week's drawings. This is accounted for by the prevalent dull trade, every route having shared in decreased drawings. Bad weather, too, had adversely affected the takings, and over last week-end there was a loss of nearly £1,000 compared with the corresponding week-end of last year.

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The Melbourne City Electricity Undertaking.

By J. H. Davies, M.I.E.E.

The Melbourne City Council electricity supply undertaking was initiated in the year 1894, the original works buildings being part of the present station in Spencer Street.

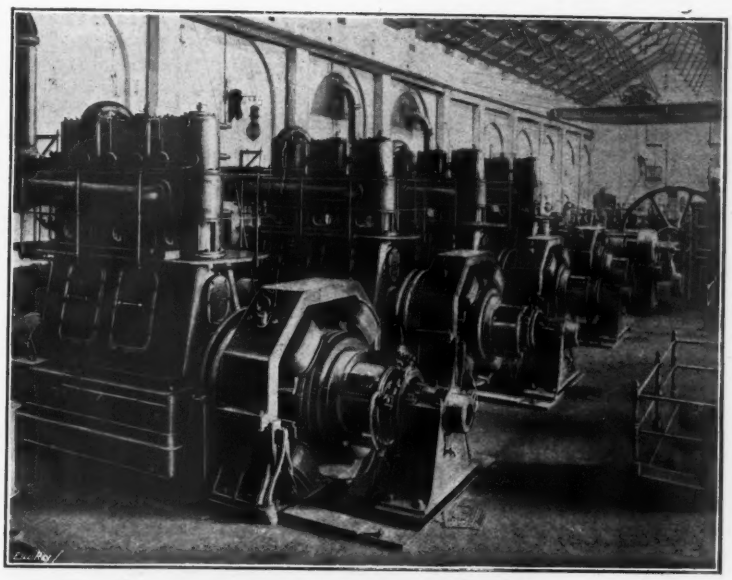
At the commencement there was no intention to undertake anything but the public lighting of the streets and markets. This was carried out on the Thomson-Houston constant current series system. T.-H. arc lamps, taking 6·8 amperes, and consuming about 350 watts, and Sawyer-Mann 32-c.p. incandescent lamps, were used in series in the main streets and lanes respectively. Each lamp was provided with an automatic short-circuiting cut-out which came into operation in the event of the lamp failing through any cause.

The plant provided for the street lighting was of a total engine capacity of 1,200 h.p., being made up of four sets of horizontal compound engines, each of 300 h.p. These were built by the Austral Otis Engineering Co., of Melbourne. Each set of engines drove six Thomson-Houston arc dynamos through a combination of countershafting and rope and leather belting, with fast and loose pulleys for every dynamo.

In 1897, the first generators were put in for the supply of energy to private consumers for lighting and power. This plant was composed of four single-phase 75-kw. alternators, generating at 2,000 volts, with a frequency of 72 cycles. The alternators were belt-driven in the same way as the T.-H. machines, and no additional engine power was installed for them. Two years later, a supplementary set was added; this was a 120-kw. Johnson and Phillips alternator, direct coupled to a Peache high-speed engine.

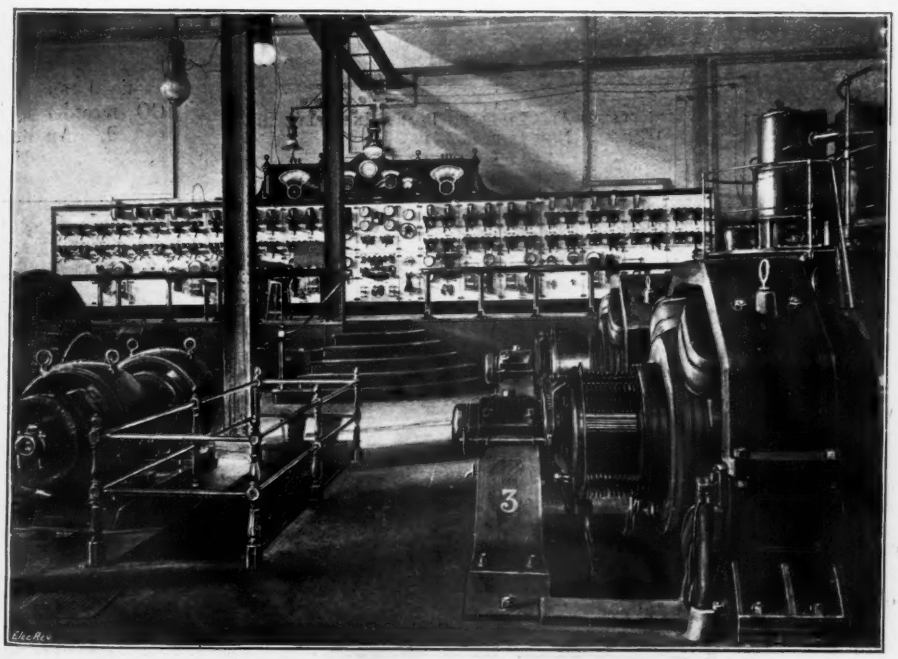
The distribution for the private supply was overhead, on wooden poles to small transformers, fixed usually on the poles or the roofs of consumers' premises. The secondary pressure was 100 volts.

The demand for private supplies of energy soon proved so promising that the City Council decided to take the supply of all electricity within the city area into its own hands,



Belliss-Parker Direct-Current Plant Installed in 1902.

and in 1900 purchased the properties of the supply companies holding statutory rights in this area. The Council, however, was not then in a position to generate the whole of the energy required, and for a time purchased its requirements in bulk from outside companies at the boundary of the city. While doing this, a new continuous-current three-wire system was installed and put into operation, in connection with which underground mains were laid in the central portion of the city, to which the companies' late consumers and the Council's were transferred.

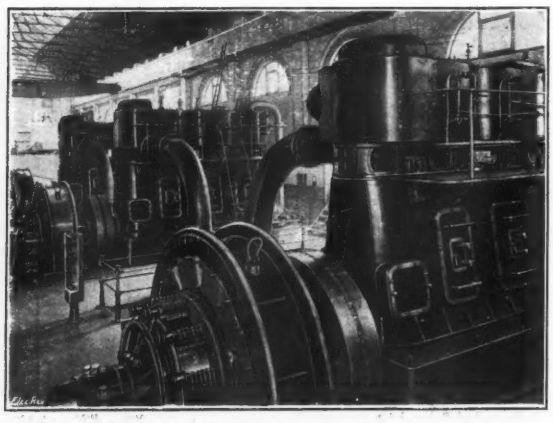


The Direct-Current Switchboard, Melbourne Municipal Plant.

Owing to the supply voltage adopted being 230, whereas the old supply was at 100 volts, nearly the whole of the consumers' installations had to be rewired before a transfer could be made. The whole change-over to the continuous-current system was practically accomplished by 1902, and the purchase of a bulk supply ceased. The direct-current underground mains supplied only that portion of the city which is within approximately one mile of the generating station, and the load outside that area continued to be carried on the overhead 2,000-volt single-phase system.

The development of the districts supplied on the overhead system advanced so successfully, that in 1906 it became

necessary to provide for considerable extension, and opportunity was taken to largely remodel this system. It was



Recent 750-kw. Allen-Crompton Direct-Current Sets Installed in 1905 and 1906.

decided to generate and distribute to static-transformer sub-stations, single-phase current, at a pressure of 4,000 volts with a frequency of 50 cycles. The change over to this system is now virtually accomplished.

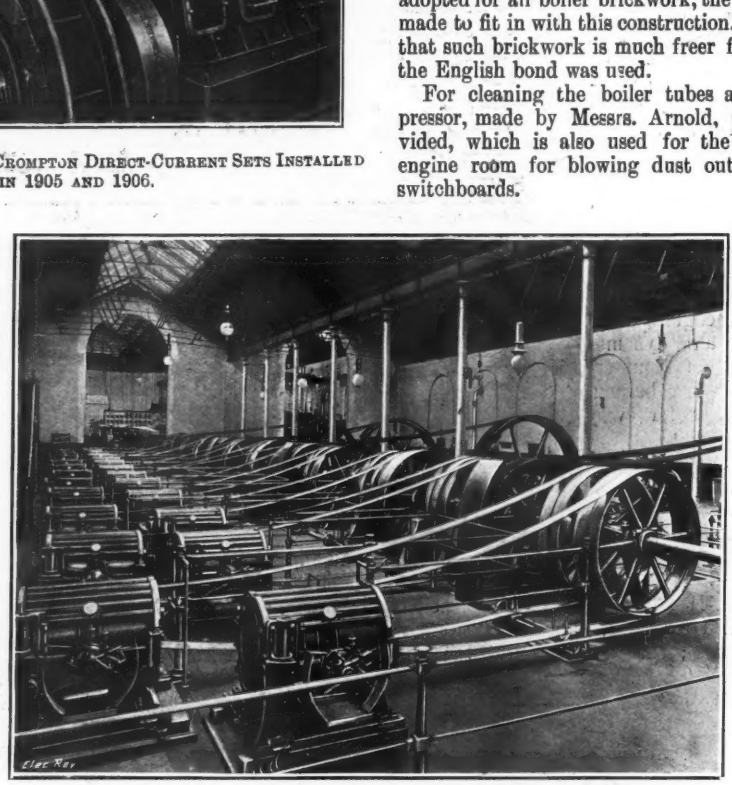
The exterior of the generating station, shown on page 929, is opposite the Spencer Street Railway Station, and about half a mile distant from the wharves on the River Yarra.

"Washed nuts," "peas," and the various grades of coal common in England, are unknown in Melbourne, where one is thankful to be able to buy just "coal." It is usually a bituminous slack, and varies in size from large lumps to dust. Coal is carted into the boiler house from rail or steamer in horse-drawn wagons, and is tipped into a hopper, falling on to a screening and crushing machine, which is driven by a 460-volt D.C. motor. From the screen and crusher, a motor-driven bucket-conveyor elevates the coal to the overhead bunkers at the rate of 22 tons per hour. The buckets are made overlapping one another in such a way that on the return journey through the basement, ashes can be pushed into them without any special filling arrangement being necessary. The coal is introduced into the hoppers of the stokers by travelling Ingrey automatic weighing and recording machines.

The boilers are in two parallel rows, with stokers facing each other. There are eight Babcock & Wilcox and two Stirling boilers, each having an evaporative capacity of 14,000 lb. per hour. Each has its own internal superheater capable of superheating 150° F. The boiler pressure is 160 lb., and the steam is superheated to 450° F. Chain grate stokers are fitted on all the boilers, and are driven by a 460-volt D.C. motor. Two Green economisers are installed, one on either side of the boiler house; each contains 480 tubes. Excellent arrangement is made to facilitate the cleaning of these economisers. They were erected with the bottom cleaning doors permanently removed, and in the supporting brickwork, hopper-shaped compartments are left immediately under the cleaning apertures. A tunnel runs the full length of the seconomiser, and from this sliding doors open into each hopper compartment. A cleaner simply has to open such a door when the soot falls into the tunnel, and he then closes the door again. This provision obviates any necessity for shutting down an economiser for cleaning.

It is interesting to learn that the Flemish bond has been adopted for all boiler brickwork, the firebricks being specially made to fit in with this construction. Experience has shown that such brickwork is much freer from cracking than when the English bond was used.

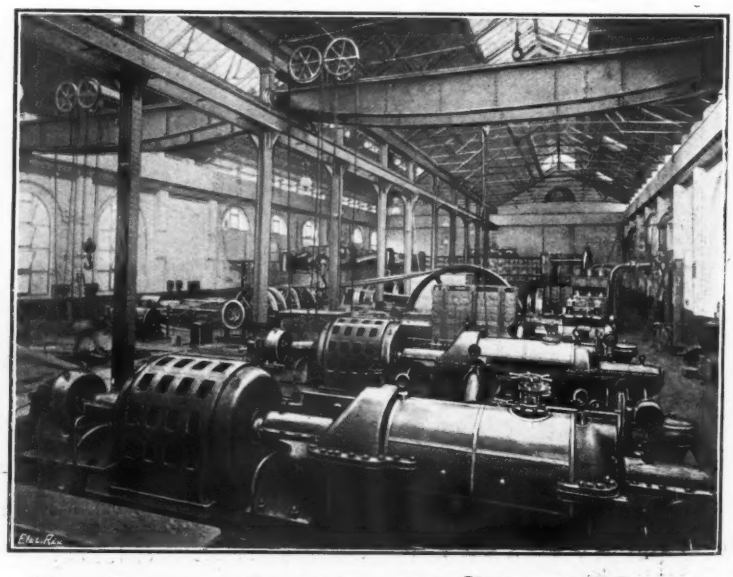
For cleaning the boiler tubes a steam-driven air-compressor, made by Messrs. Arnold, Goodwin & Co., is provided, which is also used for the air-pipe service in the engine room for blowing dust out of the generators and switchboards.



The Original Thomson-Houston Arc Lighting Plant, Installed in 1894, and Now Superseded.

The feed pumps in the boiler house are three in number, two being of the direct-acting type, and the other driven by a 460-volt D.C. motor. They are each capable of delivering 4,000 gallons per hour to the boilers from either of three sources — hot well, river water or from the public supply direct. The latter water is so pure that no softening apparatus is required.

So that a record of the state of the flue gases can be obtained, an Ados CO_2 recorder is installed. An automatic recording draught gauge is also fitted in the main flue, and regular tests of the calorific value of fuel are made with a Mahler calorimeter.

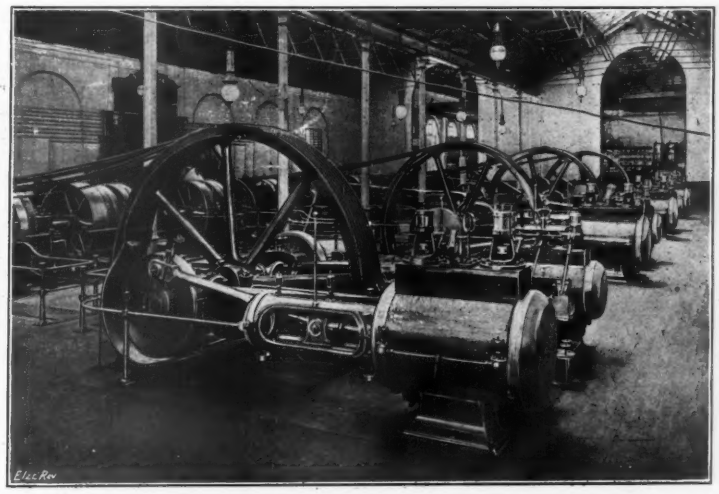


Modern Westinghouse Turbo-Alternators for Supplying the Suburbs.

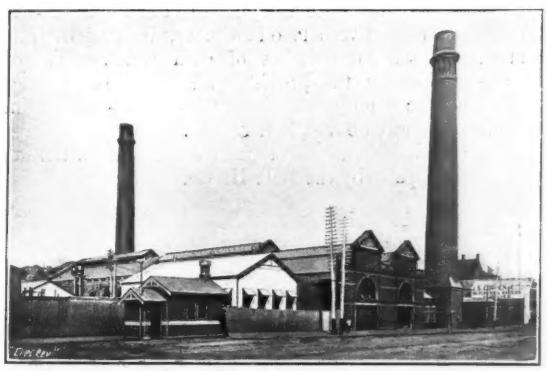
The circulating water is pumped up from the Yarra by centrifugal pumps installed at the riverside. There are three pumps, one capable of delivering 70,000 gallons per hour, driven by a 30-H.P. motor, the other two being each capable of delivering 140,000 gallons per hour, and driven by 60-H.P. motors. The motors run on a 460-volt D.C. circuit, and the starting of them is performed by Sturtevant automatic switches, which are controlled by the switchboard attendant at the supply station, ½ mile away. Beyond a daily inspection for oiling and cleaning purposes there is no other attendance required. The water is delivered to the station through a 2-ft. main, the total head on the pumps being about 40 ft.

As stated in the earlier part of this description, there are two distinct systems of generation:—Direct current at 460 volts between outers; and single-phase A.C. at a pressure of 4,000 volts. In the engine house these systems are kept entirely separate—being installed at opposite ends of the room.

The direct-current generating plant is of 3,850-KW. capacity. The initial installation made in 1902 comprises four 350-KW. sets and one of 200 KW.



Australian Built Engines, Driving the Old Thomson-Houston Plant.



Exterior of Melbourne Municipal Power Station.

The dynamos are shunt-wound 460-520-volt Parker machines, direct-coupled to three-crank tandem-compound Belliss engines, running at 340 R.P.M. The engines exhaust to their own surface condensers placed below them in the basement, or through automatic relief valves to the atmosphere. The condensers were made by the Austral Otis Engineering Co., and have Edwards three-throw air-pumps, combined with single-crank force pumps for delivering the condensed water to the oil separating and filtering plant.

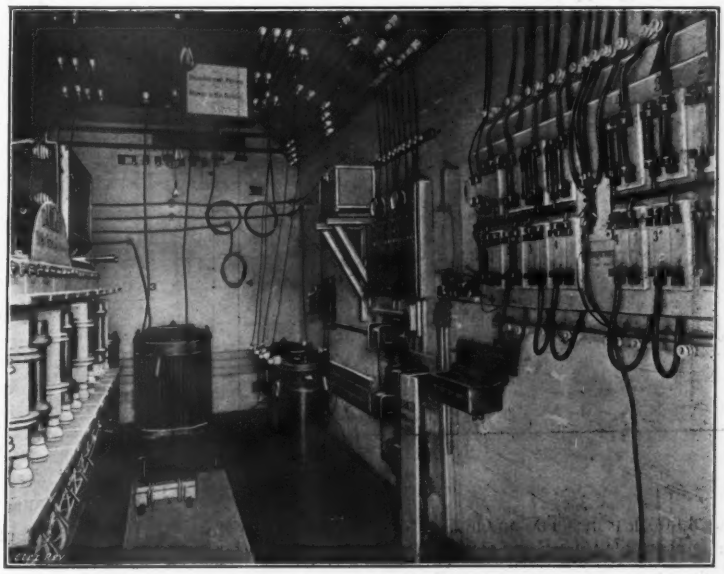
In 1905 and 1906 extensions became necessary, and two 750-KW. sets were added. These generators are 12-pole, 460-520-volt, shunt-wound machines, made by Messrs. Crompton & Co., and are each direct-coupled to Allen three-crank, triple-expansion engines running at 275 R.P.M., and complete with their own surface condensing plants.

All the above plant soon became fully loaded, and an additional 750-KW. Allen-G.E.C. set, similar in type to the earlier ones, had to be ordered. This has been in operation now only a few months.

A motor-driven booster is used in conjunction with a storage battery. It is made up of three Parker machines, mounted on one long bedplate, the booster being rated at 160 volts, 150 amperes; a Parker motor-driven balancer was also put in with the first installation of D.C. plant. The fields are cross-connected, with resistances in their circuits to allow of hand regulation of voltage. This set has to its credit the fact that it has made a run of 2½ years without a stop; it is now kept as a spare to a new Parker balancer set of the same rating, having four poles, as well as commutating interpoles.

The D.C. switchboard illustrated is on a raised platform at the east end of the engine house. The centre panel carries the battery, booster, and balancer switches. On one side are ranged all the panels used for the switching of the positive side of the three-wire system, and on the other side are placed all the negative panels. The current is led to the board by rubber-covered, braided cables, drawn into earthware pipes, laid in the concrete floor.

For each generator circuit there is a plug switch on each pole, an Andrews circuit-breaker, fitted with reverse current tripping gear on one pole, an ammeter, and a B.T.-H. integrating wattmeter. The circuit-breaker is not on the same pole always—but alternately on the positive and negative sides of adjacent generators. The writer is given to understand that an economy of space was claimed for this arrangement. Mounted above the board are two large bus-bar voltmeters.



Typical Sub-station for Public and Private Lighting in Suburbs.

A plug-switch, ammeter, and fuse is also used on every feeder, of which there are ten on each side of the system—six being each 1 sq. in. in section, and four ·5 of a square inch each. Two neutral feeders, each ·3 sq. in. are earthed at the station only. The connection to earth is through a

Standard Street Feeder Pillar.

fuse, that on blowing, automatically substitutes a water-cooled resistance (which may be regulated) and lights signal lamps at the same time.

Behind the switchboard are installed two Tudor batteries of 140 cells each; these accumulators were put in with the original direct-current plant, but the station load is now too great to allow of the full benefit of a battery installation being obtained.

At the west end of the engine house the single-phase generators and switchboards are placed; these are all quite new. The generating units are two 750-kw. Westinghouse-Parsons turbo-alternators. The turbines are single flow, and run at 3,000 r.p.m. The amount of superheat is limited to a temperature of 450° F. by the fact that steam is used from the same source for the reciprocating engines. Each turbine has its own Allen surface condenser situated under it in the basement.

The alternators are exactly alike, and generate at 4,000-4,400 volts with a frequency of 50 cycles. The revolving field is two-pole, and is energised from an exciter mounted on the same shaft. This exciter has a commutator of special design, because of the high speed of rotation, and is fitted with radial brushgear.

The oiling of each of these sets is independent and self-contained.

A very useful connecting link between the d.c. and a.c. systems is the synchronous motor-generator plant. At present a 150-kw. set is in use. An order for an additional 500-kw. set, to be built by the General Electric Co., of Witton, has lately been given. The 150-kw. set is composed of a Brush single-phase alternator, coupled between two 460-volt, six-pole, A.E.G. direct-current motors. The present practice is to shut the turbines down during the daytime, and supply single-phase current from this motor-generator.

The a.c. switchboard is of the standard modern h.t. type, being composed of concrete cubicles and partitions separating the various generator leads, bus-bars, and feeder cables with their instrument transformers, selector switches, &c. The h.t. switchgear is situated in the basement, and is totally enclosed in a separate room.

One side of the single-phase system is earthed at the station, and all the switching can, therefore, be done on one pole, so that the switchboard arrangement is the simplest possible. A permanently earthed bus-bar is provided at the bottom of the board for the earthed side of the system; at the top duplicate bars may be used as required through selector switches.

There are three generator, one bus-bar paralleling, and nine feeder panels. All cables are paper-insulated, lead-covered, the outers being connected direct to the earthed bus-bar. The other side of the system is joined to the upper bus-bars, through the respective s.p. oil-switches, instrument transformers, and selector switches of each panel. The oil-switches are hand operated by links from the control panels, which are placed on a platform raised above the engine-room floor, directly above the h.t. gear.

The a.c. switchgear, control panels, and instruments were supplied principally by the B.T.-H. Co.

Views of Arc Lighting in Melbourne.

Before going on to the distributing system, it should be mentioned that considerable extensions are in progress in the boiler house. A new smoke-stack has been erected, and coal-bunkers, boilers, and economisers are in course of installation.

The undertaking now possesses over 30 miles of feeders and 100 miles of overhead mains.

, 1909.

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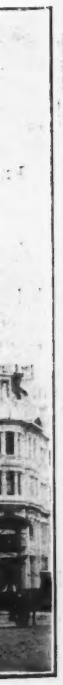

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The D.C. distribution is on the three-wire system at 460 volts between outers. Twenty single-core, paper-insulated, lead-covered cables radiate to the various feeder-pillars, which are placed at the edges of the footpaths. Most of these mains are laid in troughs, made of hardwood, and filled in solid with hot pitch. Those laid lately have been drawn into fibre conduits, spare conduits having been laid at the same time for future cables. The feeders are switched at the pillar bus-bars, from which the small distributors are led out through switch fuses. The distributors consist of single and three-core paper-insulated, lead-covered cables.

Soon after the installation of the D.C. plant the street lighting of the city was brought up to date; the open-type arcs were replaced by 135 Excello converging-carbon flame lamps, burning nine in series across the 460-volt outers of the D.C. system. In the centre of the city the lamps are 25 ft. above the ground, and are spaced about 80 yards apart. The lighting of the by-streets and rights-of-way is now done by 32-C.P. 230-volt carbon-filament lamps.

The A.C. distribution is by concentric paper-insulated, lead-covered cables, laid underground to 18 static transformer sub-stations. These feeders transmit single-phase current at a pressure of 4,000 volts to the sub-station switchboards, from the bus-bars of which it is switch-fused to the H.T. side of the transformers. There are two sets of transformers in a sub-station, one stepping down to 400 volts for supply to private customers and for incandescent street lighting, and the other transforming to 1,200 volts for public arc lighting.

All the secondary distribution is overhead by bare, stranded, hard-drawn copper cables of sizes ranging from 7/18 to 37/14. The cables are carried on porcelain insulators, having iron pins fixed in wooden cross-arms on wooden poles of grey box or iron bark.

The middle point of the secondary side of the 400-volt transformers is earthed at the sub-station, and supply is given on the three-wire system, incandescent lighting and small motor supplies being at 200 volts, while motors of 2 H.P. are connected to the outers. The earthed wire is always run on the top of the poles, and the outers on the cross-arms below it. The transformers for public arc lighting have a number of taps brought out from the unearthed end of the secondary winding, so that various pressures from 800 volts to 1,200 volts may be used according to the number of lamps in the circuit. These arc lamps are of the A.E.G. Co.'s converging-carbon, flame type, some 550 in all. The lighting of the lanes is done by 200-volt, 32-C.P. incandescent lamps.

In conclusion, it is interesting to note that the Council does a considerable business in hiring out arc lamps. Contracts are made including the hire, supply of current, carbons, and all switching and attendance. This arrangement is very popular, and some 1,100 lamps are let on hire on this plan, mostly for illumination outside shop windows. Contracts are also made for attendance and recarboning of consumers' own lamps; or lamps may be hired and cared for by the user, who only pays in addition for energy.

For lighting, a flat rate of 4½d. per unit is charged, or alternatively on a maximum demand system at 7d. for 45 hours, and 2d. for remainder. The latter option must be exercised by the consumer for not less than 12 months. These charges include cost of periodical inspection, and free renewals of ordinary incandescent lamps. No lower rate is offered (nor desired by consumers) to anyone to supply their own incandescent lamps. Power and heating is supplied at 2d. per unit, flat rate, or 2½d. for 75 hours, and ¾d. for remainder, on the maximum demand system.

During the year ending February 29th, 1908, 7,705,695 units were generated; the total connections of private consumers amount to 126,858 lamps; the motors connected number 1,143, aggregating some 3,219 H.P., and the lamps used for public lighting are 848 arcs, and 3,163 ordinary incandescent.

In conclusion, the author would like to express his indebtedness to Mr. H. R. Harper, for granting him the facilities to prepare this article. His acknowledgments are also due to Mr. W. H. Alabaster, chief assistant electrical engineer, and to the superintendent of the generating station, Mr. E. L. Rossiter.

FREE ADVICE.

By WALTER CLAYPOOLE.

When the millennium arrives, engineers will be the most unwanted and most useless people on earth.

With the exception of a few firms engaged for a limited time in the ploughshare and pruning-hook industry, nobody else will have anything to do but lounge about in deck chairs talking of old times.

In the good old days—they will say with a groan—a fellow had some chance, but now, when every blessed efficiency and power factor is 99·9 per cent., and every wretched bit of running machinery is totally enclosed, and dust, damp, gas and fool-proof, besides being self-feeding, oiling, regulating, starting and stopping—well, what's the good of us anyway?

Then, to while away the time, and to strengthen his memory of the half-forgotten customs, rules and etiquette of the engineering professions, someone will turn up an ancient file of this journal. It is to meet such a contingency that these notes are written.

Advice to Students.—1. Remember that college days only come once to any man; therefore, make the most of them.

Each day to an earnest soul brings its own joys, its own surprises, its own short circuits. There is so much to do, so much virgin soil to turn over, so much *débris* for the "lab." boy to clear up.

In later years, when you are the *blasé* chief of a 5,000,000-KW. station, with what tenderness will you recall your early exploits. No mischance, however ghastly, with a big set or a trunk main can ever approach the exquisite horror of the moment when first you put an ammeter across the bus-bars.

2. Remember that in any difference of opinion you may have with the Professor, the benefit of the doubt should be in his favour.

If you have inadvertently charged the secondary cells with salammoniac, do not seek to justify your action should he speak harshly to you. For all you know, there may be a better way.

3. Remember that faith and good works are equally necessary to engineering salvation; which, being interpreted, means that while you will have to take on trust a lot of things which great and good men before you have worked at, and which are now put up neatly into tabloid form, you must not expect people to accept your uncorroborated statement that you also are a jolly smart man. The tendency will be to wait a while, and see what you can do, and how you do it.

At an Examination.—1. On taking your seat in an examination room assume a half-bored, half-amused expression; it will be found most effective. The Examining Inspector will probably find an opportunity of shaking hands with you and assuring you that he has no personal feeling in the matter. It is merely as a matter of form that you are asked to glance through the paper and jot down the solutions of the problems. Red tape, you know, red tape. The C and G people are simply wrapped up in it, and if they were to issue a diploma in even the most deserving case—well, like your own, for instance—without the formality of an examination, there would be the very dickens to pay. They would have Dewar, and Swinburne, and Hammond, and all the whole gang of 'em clamouring for one.

2. When reading through the examination paper, express your feelings in appropriate terms. It is a sign of weakness to remain silent, and if there is anything of which you disapprove the Authorities like to hear of it. Suitable expressions are, "My hat!" "What an awful snorter!" "It's enough to give a fellow hysteresis!"

3. Answer the questions concisely and to the point, but do not be too brief. For instance, in taking a problem of this type:—

"A three-phase, semi-enclosed induction motor with Sturmey-Archer gear and automatic feed is wound for 500 volts and 50 periods. It is proposed to run it on another circuit at 50 volts and 500 periods. State briefly whether, in your opinion, it would be advisable to rewind the rotor to meet the new conditions, and if so, how many conductors

the new rotor should possess." It is insufficient to reply "not half." Such an answer not only shows a lack of accuracy, but is liable to be misconstrued.

4. Keep on the look-out for catch questions. Every examination paper contains one at least. When you have spotted it, take up a firm attitude. Say to the sentry, "What price No. 4?" This will confuse him, and you can follow up your advantage by letting him know that you are aware that the chap who set the paper gets 6d. for every candidate who falls into the trap.

5. Problems requiring numerical calculation will afford opportunity for showing what you are made of. Do not shuffle out of your responsibilities by giving approximate results. The number of lines of force emanating from an N pole of strength 1,000 is $4,000\pi$. Don't be tempted to give it as 12,570 approx. The answer is, of course, 12,566·37061 . . . . Most examiners will be satisfied with 10 significant figures.

When looking for a Job.—1. Before applying for a job, situation, position, berth, or other excuse for pocketing wages, it is usual to possess what are known as qualifications.

The qualification most in favour among applicants is an uncle on the board. It is very potent and will save a lot of trouble—at first.

2. In sending in your application, be careful what style you adopt. If you are short of testimonials and this is your first job, write a short, friendly note in the chatty style.

This will impress your prospective employer with a sense of your importance and probable value. Your method, he will argue, may not be orthodox, but that is doubtless merely the eccentricity of genius. He may even put you down as a consulting engineer tired of ultra-respectability.

Don't mention salary, even if the advertisement invites an expression of opinion on that point. It is extremely annoying to find afterwards that he was prepared to spring another 15s. a week. Rather let him gather that salary is not so much an object as the pleasure of being allowed to bask in the light of his countenance. This ought to be worth an extra £50 a year, at least.

In the remote event of your application not being answered, your obvious duty is to write an indignant letter to the editors of all the engineering papers. This kind of discourtesy is getting too common.

Hints for Polytechnic Lecturers.—1. It is important to ascertain early in the session whether there is likely to be trouble with precocious students. These should be weeded out at once, as nothing is more vital than keeping the ratio $\frac{\text{lecturer's knowledge}}{\text{student's ditto}}$ always > unity.

2. The treatment of awkward questions requires great ingenuity. Some lecturers cultivate a slight deafness; this enables them to misunderstand a question of this character, and to give such a lucid and witty answer, although not perhaps bearing on the subject, that the whole class is put into a good humour, and the questioner retires discomfited.

It will pay a lecturer who adopts this line of defence to prepare, at the beginning of the session, a careful selection of these lucid and witty replies. Nothing will increase his prestige so much as to be always ready on an emergency. His infirmity of hearing will invariably excuse any discrepancy between the question asked and the query answered, so long as the reply is brilliant.

3. On no point do opinions vary so much as on the best method of getting across unknown country when lost in a blackboard proof. If within sight of the end of the lecture, some men prefer to feel their way slowly and warily, keeping on sure ground till time is up and resuming the journey next week, in the meantime having had a good look at the map.

Others contend that it is better to leap gracefully over dangerous places with the phrase—"It is obvious that—" This makes the bright students rather ashamed of themselves for not seeing, and, of course, the others don't count.

Another and very effective method is to fill the blackboard as quickly as possible with the nearest approach to the truth you can manage, and clear it off again before anyone has time to detect any errors. The fag end of the proof, if you happen to remember it, may be written boldly on the freshly-cleaned board, and will be found to inspire perfect confidence that all is well, and that you are really no end of a mathematician.

4. Candid and unashamed ignorance on certain subjects is one of the most invaluable assets a technical lecturer can possess.

Not to plead ignorance of the number of pecks in a bushel would be to put oneself outside the pale; as well might a judge omit to ask for information as to the identity of Beerbohm Tree.

Then, again, there is the question of arithmetic. It is fatal, for instance, to be expert at Board School multiplication. Never be without a logbook in your hand, and let the class gather that you would sooner stir your tea with a slide rule any day rather than with a spoon.

Hints for Inventors.—1. Never forget that it is the little things that pay. The inventor of the rubber tip to lead pencils received £5,000,000 for the Patagonian rights alone, while the fortunate patentee of copper tips to dancing pumps is said to receive a royalty of 1s. 5d. a pair.

2. Care should be taken to approach the right people when trying to dispose of an invention. It is useless to expect the Admiralty, for instance, to take much interest in a reversible baby comforter.

3. In fixing the purchase price a number of points have to be taken into account.

In the first place, the nature of the invention will, to a large extent, determine what form the purchase consideration shall take. In the case of an improved aeroplane, for instance, a royalty of so much per dozen will clearly be inappropriate, and payment based in some way on the performance of the machine will be found preferable. An easy rule to remember is to reckon £1 per oz. (avoir.) of lifting capacity.

In the second place, it is advisable to ascertain as nearly as possible how much money the prospective purchaser has got. You then fix your price about £50 above high-water mark. Of course it will give him an awful shock, but he will have all the greater idea of the value of your invention. Naturally, he will start beating you down, and this will give you an opportunity for a few graceful concessions. £100 knocked off your price now, if done nicely, ought to close the bargain.

Hints for Consultants.—1. It is contrary to the etiquette of the profession to advertise. There is, however, no fixed upper limit for the area of brass plates excepting manufacturing convenience.

Little can be said in favour of electric signs, and it is in distinctly bad taste to display a flag inscribed with any such notice as "The old firm," or "Our motto, Civility and Satisfaction."

2. A consultant should be a specialist—it pays. Once become known, for instance, as the one Authority on the habits of the electron, and clients will form a *queue* to ascertain your opinion on nitro-glycerine as a sedative.

If you have achieved fame as an electric furnace expert you may expect to get a handsome retainer in *re* the Liquid Helium Refrigerating Co. *v.* Jabberwock and others.

3. It is, however, fatal to know too much. The limit is what your clients credit you with, and, if you are an acknowledged authority on spring mattresses, don't announce that you also know all about spring onions. Wait until somebody finds it out, and, verily, you shall have your reward.

Hints for Contractors and Poor-Law Guardians.—1. Cut out of the *Times* a *verbatim* report of the Mile End Case.

2. Frame it.

3. Hang it over the bed.

4. Read it when you retire to rest, and again when you arise from slumber.

5. Mark, learn, and inwardly digest it.

The Illuminating Engineering Society.—Mr. Gaster informs us that the supporters of this society met on May 25th, with Mr. Chas. Hastings in the chair, and formally approved the constitution and by-laws recommended by the Executive Committee, which was appointed at the inaugural dinner in February last.

TELEGRAPH and TELEPHONE NOTES.

Telegraphic Interruptions:—

Jamaica-Colon	... May 6, 1909
Dakar-Conakry	... May 13, 1909
Tangier-Cadiz	... May 19, 1909

Telephone Engineers on Trial.—The trial of the four English electrical engineers—Messrs. Burton, Cowan, Hogarth and Robinson—who were arrested on March 23rd last year on the charge of purloining drawings from the Bell Telephone Co. when leaving that firm to join an English company, was resumed on the 27th ult., all the defendants being present. Evidence was given by M. Damoiseau, engineer to the Bell Co., to the effect that there was nothing really important in the documents said to have been purloined; Mr. Connor, manager of the firm that engaged the defendants, and formerly chief engineer to the Bell Telephone Co., said the copies were of no value, and that in telephony a constructional secret was an impossibility.

On the 2nd inst., according to Reuter, counsel on behalf of the Public Prosecutor, asked for the acquittal of the defendants, declaring that there had been no theft, and regretting the detention of the four engineers; the defendants' counsel showed that neither theft nor abuse of confidence had been committed, and the Court acquitted the defendants, with costs against the Bell Telephone Co. The verdict was received with cheers.

Venezuela.—The French cable company, it is stated, in return for interfering in political matters, has ceded to the Venezuelan Government all the coast cables owned by it, and will receive a concession for 20 years, as well as the right to establish wireless telegraph stations. The rates to Venezuela have been reduced from 7s. 5d. and 7s. 7d. to 5s. 2d. per word.

Wireless Telegraphy.—The telegraph authorities in Shangbai consider it to be impossible to establish and to work successfully the ordinary land telegraph lines across the great deserts between Peking and the extreme north-west; an order has therefore been sent from the Board of Communications to the telegraph administration, directing it to obtain tenders from foreign firms for wireless telegraph installations. The provision of wireless telegraphy in the interior is considered by the administration to be one of the most important needs of China at the present time.

The Belgian Military authorities have placed a contract with the Société A.E.G.—Union Electrique, of Brussels, for the supply of a number of portable wireless telegraph stations.

A wireless telegraph station is being established at Stoneywood, in the North of Scotland.

The Ceylon Government is desirous of establishing wireless communication between Colombo and Minicoy; stations have been installed at Mergui and Victoria Point, in Lower Burma.

The Isthmian Canal Commission, according to the *Telegraph Age*, has decided to erect a station at Porto Bello to communicate with the one already installed at Colon.

It is stated that the atmosphere near New York Harbour is so filled with wireless messages that it is difficult for the steamship lines to pick out messages.

The Admiralty is constructing a wireless telegraph station near Ipswich.

CONTRACTS OPEN and CLOSED.

OPEN.

Atherton. — June 9th. Two 30-KW. transformers, 700 yards of H.T. cable, two H.T. switches, for the U.D.C. See "Official Notices" to-day.

Australia. — MELBOURNE. — July 14th. One direct-current steam-driven generating set of 1,000, 1,250 or 1,500 KW., for the Council. See "Official Notices" May 14th.

MELBOURNE.—150 relays, non-polar, for the Postmaster-General. See "Official Notices" May 28th.

MELBOURNE.—August 4th. Overhead travelling crane, for the Electricity Supply Committee. See "Official Notices" to-day.

Buxton.—June 14th. Small nuts or slack for one year, for the U.D.C. electricity works. Apply to the Engineer.

Carlisle.—June 14th. Stokers, superheaters, 300-KW. steam turbo-generator (D.C.), for the Electricity Department. See "Official Notices" May 28th.

June 11th.—Paper-insulated lead-covered cables for the Electricity Department. See "Official Notices" to-day.

Clacton-on-Sea.—June 16th. Electric service fittings and joint-box compound, for a year. G. T. Lewis, Clerk to the U.D.C.

Devonport.—Direct-current meters, cables, oils, &c., for the Electricity Committee. See "Official Notices" to-day.

Coal and general stores for the Council's electricity department. Borough Electrical Engineer, Newport Street, East Stonehouse.

Dudley.—June 10th. A motor-generator with switchgear, for the Corporation. See "Official Notices" May 21st.

June 10th.—Traction battery and automatic booster, with switchgear, for the Corporation. See "Official Notices" May 28th.

Germany.—The municipal authorities of the town of Neuwied-am-Rhein have recently decided on the extension of the central electric lighting station, and are about to invite tenders for the supply of the necessary plant.

Glasgow.—The Trustees of the Clyde Navigation having had a report on the relative merits of electric and hydraulic capstans, agreed with the reporter that the electrical apparatus was more efficient and economical. Tenders are invited for 35 electric capstans for Yorkhill, and 13 electric capstans for Rothesay Dock. Information from the Trustees' office, Robertson Street, Glasgow.

Grimsby.—June 7th. Two superheaters for Stirling boilers, also renewal of dripping bars in existing cooling towers, for the Corporation. See "Official Notices" May 21st.

Italy.—ROME. — The *Moniteur des Intérêts Matériels* (Brussels) announces that the municipal authorities of Rome will shortly invite tenders for the construction and working of two electric tramways in that town. Rails and accessories alone are estimated at about £14,600, and they will be open to international competition.—*Board of Trade Journal.*

Leeds.—June 8th. One 100-H.P. motor for the Tramways Committee.

London.—ST. PANCRAS.—July 10th. Arc lamp carbons for the B.C. See "Official Notices" April 30th.

L.C.C.—June 15th. 200 double-deck roof-covered car bodies, 200 car sets of maximum-traction swing bolster trucks, and 200 complete electrical equipments for operation upon both conduit and overhead trolley systems. See "Official Notices" May 14th.

Manchester.—June 16th. Electric light installation for the Guardians' offices in New Bridge Street. Specification (deposit one guinea) from Mr. J. Macdonald, Clerk.

Mexborough.—June 8th. 100-KW. engine and generator, switchboard extensions, piping, and water purifier and softener for the U.D.C. electricity works. See "Official Notices" May 7th.

Rotherham.—June 11th. Electric light installation at the Grammar School. See "Official Notices" to-day.

Rugby.—June 8th. About 880 yd. of paper-insulated, lead-covered and armoured service cable, for the U.D.C. Arthur Morson, Clerk, Benn Buildings, Rugby.

Salford.—June 14th. Battery, booster and switchgear, for the Electricity Committee. See "Official Notices" to-day.

Sculcoates.—June 9th. 15-KW. D.C. dynamo, driven by steam turbine or high-speed engine, for the Guardians. See "Official Notices" May 28th.

Southampton. — Sundry heavy cables for low-tension trunk mains for the electricity department. See "Official Notices" May 21st.

South Shields.—June 14th. Stores for the Corporation Tramways Department. See "Official Notices" May 28th.

Tunbridge Wells.—June 12th. High and low-tension cables for the Corporation. See "Official Notices" May 28th.

CLOSED.

Belgium. — La Société A.E.G.-Union Electrique, of Brussels, has secured a contract for the supply of a 4,000-KW. steam turbine and alternator, for the central power station of the Société des Tramways Bruxellois, and two 1,100-KW. sets for the Société des Clouteries et Tréfileries des Flandres.

Bridlington. — The T.C. has accepted the following tenders for the electric light department:—

Holdsworth & Sons, Bradford.—Lancashire boiler, £648 10s.
Anchor Cable Co.—Cables for a year.

Dartford.—The U.D.C. has accepted the following tenders for supplies to the electricity works:—

J. P. Hall & Sons, Ltd., condensing plant, with Rees Roturbo pump	£1,038
Chamberlain & Hookham, Ltd., meters	72
Ferranti, Ltd., meters	72
S. W. Gibson & Co., general stores	27
Johnson & Phillips, Ltd., house service cable, &c.	120

Dewsbury.—The tender of Messrs. Fox & Co., of Batley, has been accepted for electrical work at the new Nurses' Home at Dewsbury Workhouse Infirmary.

Edinburgh.—The Corporation contract for five ampere-meters has been placed with the Bastian Meter Co., Ltd.

Glasgow.—The Tramways Committee recommends acceptance of the following tenders:—

Three-core cable.—National Conduit & Cable Co.
Mica.—F. Wiggins & Sons and R. & S. Baxter.
Water recorder.—Glenfield & Kennedy, Ltd.
Ash hopper and water tanks.—Barrowfield Ironworks, Ltd.
Scrap for disposal.—(*a*) Lead and zinc, R. M. Easdale & Co.; (*b*) spelter and white metal, Shearer Bros.; (*c*) brass, copper, brass dust, Sam. Galbraith; (*d*) rubber, cable, wire, wood, John D. Young; (*e*) copper turnings and fibre cutting, Mackie & Ingram.

Hounslow.—The Council has accepted the offer of the Tudor Accumulator Co., Ltd., to supply and maintain 28 additional cells to the storage battery at the generating station, the annual maintenance charge paid to be increased by £26 until September 30th, 1916, and by £7 from that date until the date of the expiration of the contract entered into in February, 1907.

Kingston-on-Thames.—The T.C. has accepted the tenders of Siemens Bros. & Co., Ltd., and W. T. Henley's Telegraph Works Co., Ltd., for cables; and that of the Electrical Co., Ltd., for Aegma metallic-filament lamps (50 c.p.), at 2s. each.

Leyton.—The U.D.C. has accepted the tender of the Standard Cable Co. for the annual supply of service-line cable at the following prices:—

(*a*) Size of cable, 7/14; (*b*) basis price, £70 18s.; variation scale, (*c*) copper 7s. 2d., (*d*) lead 15s. 2d., (*e*) rubber 4s. 10d.
(*a*) 7/16, (*b*) £81, (*c*) 4s. 7d., (*d*) 11s. 10d., (*e*) 3s. 6d.
(*a*) 7/18, (*b*) £34 19s., (*c*) 2s. 7d., (*d*) 8s. 3d., (*e*) 2s. 4d.
(*a*) 3/18, (*b*) £23 5s., (*c*) 1s. 1d., (*d*) 7s. 3d., (*e*) 1s. 6d.

London.—L.C.C.—The Education Committee of the L.C.C. has ordered the General Electric Co. to supply a motor-generator in connection with the extensions of the L.C.C.'s School of Building at Brixton, and to do the necessary work in connection with the enlargement of the existing switchboard, at £330 10s.

Hammersmith.—The following tenders were received for a coal conveyor and projector for the electricity works extension of plant scheme:—

Fraser & Chalmers	(recommended)	£660
Babcock & Wilcox		890
H. Simon, Ltd.		1,198
Applebys, Ltd.		1,440

For six high-tension automatic oil-break switches the following were the tenders:—

Switchgear Co., Ltd.	(recommended)	£8 14 6 each.
Spagnoletti, Ltd.		10 0 0 „
British Westinghouse Co.		12 12 0 „
General Electric Co., Ltd.		15 10 0 „
R. W. Blackwell & Co., Ltd.		16 2 0 „
Cowans, Ltd.		16 19 0 „

L. and N.W. Railway.—Messrs. W. Geipel & Co. have secured the contract from the L. and N.W. Railway Co. for the whole of the carbons required during the year ending June, 1910, including open type, enclosed type, and flame carbons of Henrion make, for which this firm are sole representatives for the United Kingdom. We understand that the contract is for 1,170,000 carbons.

Rochdale.—The Gas and Electricity Committee, on May 26th, accepted tenders for 3,700 tons of coal for the electricity works. The prices averaged 6d. per ton less than on the previous contract; this means a saving of close upon £100.

Southampton.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for a new boiler, at £1,530.

Walthamstow.—The District Council has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., for paper-insulated cables.

FORTHCOMING EVENTS.

Royal Institution.—Friday, June 4th. At 9 p.m. Discourse on "Researches in Radio-telegraphy," by Prof. J. A. Fleming.

Thursday, June 10th. At 3 p.m. Lecture on "A Modern Railway Problem: Steam *v.* Electricity," by Prof. W. E. Dalby.

Friday, June 11th. At 9 p.m. Discourse on "Problems of Helium and Radium," by Prof. Sir J. Dewar.

Physical Society.—Friday, June 11th. At 8 p.m. At the Imperial College of Science. Papers by Dr. A. Russell and Mr. A. Wright on "The Arthur Wright Electrical Device for Evaluating Formulæ and Solving Equations"; by Mr. C. C. Paterson on "The Proposed International Unit of Candle Power"; by Dr. J. W. Nicholson on "Inductance and Resistance in Telephone and other Circuits"; and by Mr. G. W. Walker, "Note on Terrestrial Magnetism."

Electricity on a Battleship.—The electrical equipment of the battleship *Téméraire* recently underwent a preliminary trial before the ship was taken over. The electrical equipment on board a warship is extending at such a rate that it is always interesting to follow the development embodied in a new ship at the present day. In this case electricity has practically superseded steam and hand power in almost every department. There are over one hundred and thirty electromotors in the ship; they are used for pumping, the ammunition supply, coaling, ventilating and cooling, working the various tools, and air-compressing machinery for the torpedoes. The lighting system, bell and telephone systems, and the fire control, are of a most complete nature.

NOTES.

Procedure at the Institution of Electrical Engineers.—In a letter which came to hand too late for publication in our last issue, Mr. E. W. Cowan raises several questions regarding the procedure at meetings of the Institution, which he thinks—and we agree—at present fails to elicit the best and most profitable discussions on the papers. With a view to improving the conditions, Mr. Cowan suggests that members who send in their names as desirous of taking part in a discussion shall submit in advance a very brief summary of the remarks which they propose to make; the President, with a list of these points before him, can then conduct or "edit" the debate with due regard to the importance of the respective contributions, and curtail irrelevant discourse, so as to leave more time for the really useful matter, so much of which, though tendered, is at present ungotten. Sending a communication to the *Journal* is a feeble and unattractive substitute for the living word. Further, Mr. Cowan urges that the author should be given an opportunity of replying promptly at reasonable length to the points raised, and he suggests that when possible, the discussion of a paper might be taken by compartments, taking the points of greater importance first, and allowing only those of minor moment to be crowded out. There might also be at least a few minutes for general discussion, apart from the contributions of those who had sent in their names, the author replying on each point as it was raised.

Mr. Cowan's suggestions appear to us to be admirable, at any rate in theory; how far they could be carried into effect is less certain. We have from time to time drawn attention to the inefficiency and frequent abuse of the existing system, and we may add to Mr. Cowan's suggestions one that we have often put forward—namely, that the papers be sent in advance to *every* member of the Institution, not only to those who apply for them, and that they be taken as read, with a brief introduction by the author. To come to a meeting to discuss a paper without having previously studied its contents—as members often do—is little short of an insult to the author, and is undoubtedly an abuse of the privilege of addressing an intellectual and expert audience.

Tramway Workers.—The nineteenth annual Conference of the Amalgamated Association of Tramway Workers was opened at the Labour Institute, Bradford, on Wednesday last week, about seventy delegates from all parts of the country attending, representing 14,833 members. The delegates visited the tramway depôt at Thornbury, and were shown over the car-building works by Mr. C. J. Spencer, general manager of the Bradford tramways.

Electric Steel.—The Cockerill Co., of Liége, has just started an electric furnace, built on the Girod system with one electrode, and having a capacity of from 2 to 3 tons of steel per charge. The dynamos generating the current are driven by internal combustion engines supplied with gas from the company's blast furnaces.

The *Journal du Four Electrique* reports that the Cie. des Aciéries de la Marine have been negotiating with the Gesellschaft Elektrostahlangen, of Berlin, for the installation of a Roechling Rodenhauser induction furnace at their works. The Cie. Générale d'Electricité de Creil have been given the electrical equipment work. This will be the first apparatus of its kind to be installed in France, where up to the present preference has been given to electrode furnaces.

Fer et Acier of Brussels reports that new experiments made with electric furnaces at Ludvika in Sweden confirm the hopes for their success previously expressed. The new steel works installation made according to the plans of Dr. Haanel, director of the mines of the Electric Smelting Co. of Canada, has been a great success. This company had signed a contract for the installation, during the coming summer, of electrical steel works, and it will be the first to start commercial production by means of electric foundries. The success obtained in Sweden makes it possible to anticipate a great development of the metallurgical industry of Canada.

Manchester Engineering Trade.—The *Times* states that a conference between representatives of the Manchester District Engineering Trades Federation and a joint committee of trade unions concerned was held in Manchester on the 27th ult. to discuss without prejudice the question of an additional reduction of 1s. a week in day-rate wages, and of 2½ per cent. in piece rates. The conference was adjourned for a month without any decision having been arrived at, and the question will be referred to the members of both organisations. 17,000 workers are affected.

Institution and Lecture Notes.—Institution of Mining Electrical Engineers.—A general meeting was held at Sheffield on Saturday, May 12th, under the chairmanship of Mr. William Maurice, of Hucknall Torkard, the president, who explained the lines on which it was proposed to develop the Institution. He suggested that branches should be formed in every mining centre, each branch having its own president, council and secretary. The general council would be mainly an organising and administrative body, drawn from representatives of local councils. Mr. J. Williams, 3, Moresby Parks, Whitehaven, will supply full particulars to anyone who applies to him for them.

A meeting was also held on May 22nd, at Cardiff; Mr. Sydney F. Walker presided, and arrangements were made to form a local branch meeting alternately at Cardiff and Swansea. Mr. E. J. Davies, Rock Cliffe, Penygroes, is the local secretary. The membership of the Institution now reaches nearly 100 members.

Salford Technical and Engineering Association. — The members of this Association are paying a visit to Ireland from June 2nd to 6th. Yesterday the Belfast electric power station was to be visited, and to-day there will be a tour of the works of Messrs. Harland & Wolff, Ltd.

Scottish Tramway Officials' Association.—Mr. R. S. Pilcher, Aberdeen, has been elected President of this Association.

On Friday last, the members of the Association met in the Corporation tramway offices, Aberdeen, and Mr. Pilcher, the general manager of that system, read a paper on "Current Consumption," after which a general discussion took place, both on the paper and on other tramway matters of importance. The afternoon was profitably spent in a visit to the workshops of the Aberdeen Corporation tramways, which are amongst the best equipped tramway repair shops in the country for a system of its size. Amongst other interesting things seen, was a water car that this department uses for watering the principal streets of Aberdeen, and which is capable of sprinkling a surface 20 ft. wide, the cost of this being borne by the cleansing department. The members were later on entertained to dinner by the Aberdeen Corporation Tramways Committee, and the following day was spent in visiting the suburban lines and the Corporation power station. It was arranged that the next meeting be held in August, and that a paper be read on "Trackless Trolleys" and "The 1870 Act," which all tramwaymen agree is long out of date.

At the Royal Naval Artificer Engineers and Engine-room Artificers' Benevolent Society's headquarters in Chatham, the first of a series of lectures on scientific subjects has been delivered. Mr. W. P. Durtnall taking for his subject the electrical transmission of power for main marine propulsion, pointed out the advantages that would be gained by interposing electricity between the high-speed turbine and the screw shaft. He gave figures to show that for the same amount of energy the fuel consumption would be very much less on account of both increased bunker capacity and reduction of weight in machinery.

Sports.—The Electrical Engineers (London Division) held their Corps Athletic and Cycling Trials and Championships on Wednesday evening last, at the Stamford Bridge Sports Ground, Chelsea. The winners were:—100 yards race, Sap. E. C. Abbott-Young; ¼ mile cycle race, Sap. J. Roden; high jump, Sap. K. C. Wilson; ½ mile race, 2nd Cpl. L. G. Applebee; 120 yards hurdle race, 2nd Cpl. F. G. Engholm; 1 mile cycle race, Sap. A. G. Argent; ¼ mile race, 2nd Cpl. G. Lees; long jump, Sap. F. S. Parkes; 5 miles cycle race, Sap. W. E. Cox; 1 mile race, Sap. J. R. Birch; inter-company tug-of-war, "B" Company beat "C" Company. The prizes were presented by Col. R. E. B. Crompton, C.B. Major H. M. Leaf was president of the Sports Committee and referee, and Q.M. Sergt. G. A. Applebee hon secretary.

Electric Shock Fatality.—A correspondent says that while working near a dynamo in Carrongrove Paper Works, Denny, on Friday, an employé named Daniel Brown accidentally touched a live wire and was killed.

Appointments Vacant.—Teacher of electric wiremen's work, also laboratory demonstrator, at the Acton and Chiswick Polytechnic; fourth assistant engineer for Hammersmith electricity department (£130); demonstrator and assistant in the Laboratory of the Glasgow and West of Scotland Technical College (£100). See our advertisement pages to-day for particulars.

Electricity Works and Tramways Tables.—As our Annual Tables are about to go to press, we shall be glad to receive final corrections at the earliest possible moment.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The E.L. Committee of Derby T.C. has increased the salary of Mr. G. Drabble, assistant mains superintendent, from £100 to £120 per annum.

Mr. Harold Dickinson, engineer and manager of the Leeds Corporation electricity undertaking, was married at Emmanuel Church, Leeds, on Friday last, to Miss Alice Bartram, of Savile Place, Leeds.

The Blackburn electricity staff has presented a solid silver coffee pot to Mr. F. H. Corson, chief assistant, who is leaving to become borough electrical engineer at Gloucester, and a gold pendant and brooch combined, set with pearls and a peridot to Mrs. Corson.

The staff of the Heston and Isleworth U.D.C. electricity works presented Mr. W. Lawson, engineer-in-charge (before leaving for Glasgow), with a morocco-bound dressing case. Mr. P. S. Rycroft made the presentation.

Mr. Gerald D. Laing has been appointed engineer and representative to the Hexham and District Electric Supply Co., Ltd.

The salary of Mr. John Downie, chief clerk in Aberdeen electricity department, has been increased by £50 per annum.

The Stoke-on-Trent T.C. has increased the salary of the borough electrical engineer from £350 to £400 per annum.

On June 1st, at St. Mary's, Beighton, near Sheffield, Miss May Wing was married to Mr. L. F. Bickell, distributing engineer, at Willesden.

Tramway Officials.—Mr. J. Gray Scott having completed his work as general manager and chief engineer of the Electric Traction Co. of Hong Kong, Ltd., in connection with the system which he went out to inaugurate five years ago, left for home in April on the *Nippon Maru*. He is due to arrive in this country any day. Prior to his departure a dinner was given in Mr. Scott's honour at the Hong Kong Hotel. The toast of the evening was moved by the Hon. W. Chatham, C.M.G.

General.—The *Times* states that the Vienna Academy of Sciences has elected as a corresponding member Mr. Horace Darwin, Chairman of the Cambridge Scientific Instrument Co. and ex-Mayor of Cambridge.

Mr. Kenric B. Murray has resigned the position of secretary to the London Chamber of Commerce after 27 years' service. Mr. Charles E. Musgrave has been appointed in his place.

Mr. Horace H. Leage, A.M.I.E.E., has resigned his appointment as sales engineer with the Electrical Co. (A.E.G., Berlin), and is starting in business at 10, City Road, E.C., as manufacturers' agent and merchant in electrical accessories. He desires to receive catalogues and price lists.

Obituary.—Mr. J. T. May.—A correspondent informs us of the death, at the age of 60 years, of Mr. J. T. May, an electrical engineer, of Broadstairs, who was a prominent public man in the Isle of Thanet, and "did much towards popularising the use of electricity in the district."

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Melton Mowbray Electric Light Co., Ltd. (53,018).—This company's annual return was filed on May 4th, when 4,000 shares had been taken up out of a nominal capital of £25,000 in £5 shares. £20,000 has been received. Mortgages and charges: £20,000.

W. T. Glover & Co., Ltd. (56,124).—This company's annual return was filed on April 2nd, when the entire capital of £214,850 in £1 shares (100,000 preference) had been taken up. £1 per share has been called up on 67,000 preference and 50,000 ordinary shares, resulting in the receipt of £117,000. £97,850 is considered as paid on the remainder. Mortgages and charges: £176,000.

Electrophone, Ltd. (79,302).—This company's annual return was filed on April 20th, when the entire capital of £15,000 in 10s. shares had been taken up. 1s. per share has been called up on 7,027 and 10s. per share on seven shares, resulting in the receipt of £354 12s.; 5s. remains in arrears. £13,239 15s. is considered as paid, being 10s. per share on 22,966 shares and 5s. per share on 7,027. Mortgages and charges: Nil.

Erith's Engineering Co., Ltd. (84,992).—This company's annual return, made up to April 7th, has been filed. 10,447 preference and 10,000 ordinary shares have been taken up out of a nominal capital of £30,000 in 20,000 preference and 10,000 ordinary shares of £1 each. £1 per share has been called up on 447 preference and 15s. per share on 7,500 preference, resulting in the receipt of £6,072. £12,500 is considered as paid on 12,500 shares. Mortgages and charges: Nil.

Electro-Mechanical Brake Co., Ltd. (92,276).—Mortgage on sums of money due, or to become due, from the Leeds City Tramways, dated April 15th, 1909, to secure £575. Holders: Metropolitan Bank (of England and Wales), Ltd., 60, Gracechurch Street, E.C.

Cowans, Ltd. (67,378).—Debenture dated May 4th, 1909, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: W. T. Glover & Co., Ltd., Trafford Park, Manchester. Also trust deed of even date, further securing above debenture, charged on the company's lease of Victoria Works, Springfield Lane, Salford. Trustees: A. L. Ormrod, 4, Norfolk Street, Manchester; and C. Cooper, 33, Princes Street, Manchester.

CITY NOTES.

Calcutta Electric Supply Corporation, Ltd.

The annual general meeting was held at the offices, Salisbury House, London Wall, on Thursday of last week, Mr. Edmund Boulnois presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, May 21st, page 854), said that the principal items of capital expenditure during the year were £37,894 on mains; £8,098 additional machinery and tools; £5,236 on freehold land and buildings; £8,126 for meters; and £692 on furniture and fittings. The expenditure in meters was evidence of the rapid growth in the demand for electricity. On the other hand, there was a credit of £2,056 from the sale of electric fans. The item of £5,236 was on account of acquiring freehold land and buildings for the purpose of erecting engineers' quarters and stores. There had been a heavy expenditure for two new boilers. As the chairman told them at the last meeting, the company reduced their prices in July, 1906, which brought the average price for current for all purposes down from nearly 5d. to 4½d. per unit. When the company applied for their licence in July, 1907, the Government stipulated that the company should reduce the price for power purposes, and accordingly in January, 1908, it was brought down from 5d. to 4d. per unit, which brought the average to 4½d. per unit. There had been a large increase in the cost of their coal; last year they paid £7,557 in excess of the previous 12 months. They had added 35½ miles of mains to the company's system, making in all 223½ miles in operation. There were a certain number of feeders to be relaid. They had connected 675 consumers to the mains, with installations equivalent to 57,972 8-c.p. lamps. The licence granted to the company covered an area of 17½ miles, north to south,

which was equal to the distance from Edmonton to Croydon; and 13, east to west, or the same length as from Poplar to Ealing. Of course that was not all developed yet. Their engineer at Calcutta had advised them that there was a large demand for power for factory purposes. That official suggested that a ring main should be laid round the city, and so give a supply to the sub-stations. That was a large scheme, and would involve a considerable outlay of capital. The matter was still under the consideration of the board and the consulting engineer, and there was no doubt but what they would have no alternative but to adopt it. It was certain that more money would be required. During the past eight years the average annual capital expenditure of the company was £65,400, whilst the gross earnings per cent. to the expenditure had increased by from 9 per cent. to 17·4 per cent. The net profits had increased during that period from £5,394 to £58,188, and the current sold during the eight years had increased by 25 per cent. There was a rapid demand for the current, and it was clear that the company must not only carry out its statutory obligations, but also largely extend its operations to prevent any rival coming in. They had a fine property in the undertaking, and they had a good field before them.

Sir Guildford L. Molesworth seconded the motion, and after a short discussion, the report was adopted.

Electric Traction Co. of Hong Kong, Ltd.

The directors report that, for the year ended December 31st, 1908, the traffic receipts showed a considerable decrease when compared with those of 1907. The actual receipts in dollars were, however, greater, the difference being accounted for by the decline in the value of the dollar. The working expenses also show a decrease, owing, to a certain extent, to the same cause. The loss sustained in respect of subsidiary coinage amounted to £4,070, still a heavy charge upon the company. This loss, unfortunately, represents a very substantial element in the cost of working, but it is quite beyond the control of the board to bring about an improvement in the situation. In May last the directors, after consulting with their representatives in Hong Kong, decided, as there was no prospect of an early mitigation of the trouble, to alter the fares, partly as a set-off against the loss incurred, and partly in order to simplify them. As a result of the change, there has been a small increase in receipts. On July 27th, 1908, Hong Kong was visited by a disastrous typhoon, which caused damage to the company's buildings and system to the extent of about $5,000. The result for the year, after providing for all working expenses and the payment of debenture interest, was a profit of £3,756, which, added to the amount brought forward from last year, makes a total of £4,287. The directors consider it necessary to continue to strengthen the reserve for depreciation and renewals, and consequently the sum of £4,000 has been allocated for this purpose, increasing the fund to £16,000; the balance of £287 is carried forward. Mr. J J. Stodart Kennedy, late manager of the electric tramway in Bangkok, has recently been appointed by the board to take over the management of the company in Hong Kong, Mr. J. Gray Scott's agreement having expired on April 22nd, 1909.

Miles of street tramway	about 9
Number of cars in stock	26
Passengers	7,936,379
Car-mileage run	1,185,038
Earnings per car-mile	7·49d.
Expenses per car-mile	4·39d.
Average fare per passenger	1·10d.

The ordinary general meeting was held on the 26th ult. at the offices, 19, St. Swithin's Lane, Mr. E. C. Morgan presiding.

The Chairman, in proposing the adoption of the above report, said there were one or two points therein which appeared anomalous, and called for explanation. It would be noticed that the figures relating to the gross receipts and expenditure both showed a considerable diminution as compared with the previous year, the receipts being less by £5,400, whilst the expenses had diminished by some £3,300. Those remarkable discrepancies were entirely due to the lower rate of exchange which ruled during 1908. Their receipts and expenses were, of course, made almost entirely in dollars, and whilst in 1907 the rate taken for the dollar was 2s. $4\frac{1}{16}$d., in 1908 they only got 1s. $9\frac{5}{16}$d., these being the rates adopted for bringing the accounts to a sterling basis. It would be noticed that in spite of the lower exchange, the loss upon the subsidiary coinage, of which they had always had to complain, showed hardly any diminution, and now figured at the extraordinary percentage of $18\frac{3}{4}$ per cent. of their total working expenses. It was that which had caused the expenses in Hong Kong to show a less shrinkage than their receipts, the actual expenses being less by $4,936 than in 1907. It would be observed that they had carried 627,676 less passengers than in the previous year. That they attributed to an increase in fares which they made to compensate them for the increasing loss on the subsidiary coinage. That reduced the number of riders, but the people were becoming accustomed to it, and he believed the numbers were increasing again. The docks were now partially opened, but the increase they expected from that source had not come up to their expectations. They hoped, however, that the traffic would develop as time went on. They had made some changes in their organisation in Hong Kong, which would result in considerable saving in expenditure, and with some augmentation of their traffic receipts, he thought they might fairly look for larger net receipts during the current year. The ratio of working expenses to receipts continued high, being over 58 per cent., which was due to the loss of coinage which they had to add to their working expenses, although it was an item over which they could exercise no control. Without that crushing addition to their outgoings, the ratio was only about $53\frac{1}{2}$ per cent., which compared favourably with the expenses of most of the tramways now at work in the world. They had carried the population of Hong Kong 36 times in the year, which indicated that the company was filling a want. The outlook was, therefore, fairly good, but as long as the Government continued to refrain from taking steps to place the subsidiary coinage upon a stable basis they were handicapped by a serious loss which, under existing circumstances, showed no signs of diminution, and they could only hope that the urgency of the position by which they alone were not the only sufferers, might compel the Government to devote their attention to devising a remedy.

Mr. Robert Miller seconded the motion, and the report was adopted.

Callender's Cable and Construction Co.

Mr. H. Drake presided on May 27th at Hamilton House over the thirteeth annual general meeting of this company.

In moving the adoption of the annual report (see Electrical Review, May 21st, page 854), the Chairman remarked that the deplorable condition of the engineering trade in all parts of the world had restricted the company's business, but he considered the balance-sheet was most satisfactory. Dealing with the figures in the accounts, he said that in the balance-sheet the capital, debentures and reserve were the same as in the previous year, as were also the items of machinery, renewal and suspense account. Bills payable were £72,109, against £95,959; trade creditors and other liabilities £50,838, against £69,828; loans the same; whilst £72,134 was carried to profit and loss account, as compared with £81,357. On the assets side the property at Erith had been valued at £300,253, whilst no credit whatever was taken for goodwill and patents. Stocks were £101,472, against £104,689; expenditure on contracts in course of execution stood at £81,733, against £83,946; cable drums £18,828, against £19,050; sundry debtors, £185,066, as against £274,210; cash in bank £20,975, against £34,931; bills receivable £30,031, against £45,300. The balance carried to profit and loss account was £106,985, as compared with £108,572. From that had to be deducted depreciation, debenture interest and preference dividend, amounting in all to £34,587, leaving a net balance of £61,614. To this had to be added the amount brought forward from last year, which left an available balance of £72,134 as compared with £81,357 last year. A dividend at the rate of 10 per cent. for the year with a bonus of 5s. per share was recommended, leaving £45,884 to be carried forward.

Mr. C. H. McEuen seconded the motion, and the report was adopted.

Mr. Bain asked the reason for the large increase in the item of shares, investments and interests in other companies.

Mr. T. O. Callender (managing director) said the year 1908 would be long remembered as an exceedingly bad year, especially in the engineering trade, and in business connected with it. There had been strikes which affected their business in a most material way, for orders ceased. Secondly, the year had been marked by great financial stringency. Development was difficult and new enterprise in engineering departments was practically impossible. Their business, like that of others in the electrical trade, as far as London was concerned, had been practically stopped pending some decision as to the future of the electrical supply of the country. As they knew various attempts had been made by different persons to get Parliamentary powers for the supply of electricity in bulk to London, and for the past two years it might be said that no new work had been carried out. He was glad to say that the Bill which was eventually passed last session had lifted the cloud which hung over them, and already they had received orders to the extent of many thousands of pounds for mains for the extension of the existing systems. One could hardly imagine the extent to which Parliamentary inaction could stop business, unless one was at the head of affairs. Finally, they had been greatly affected by the metallic-filament lamp, as the existing companies had found their mains sufficient to deal with the demand. They, however, looked on that lamp as the best thing they could have, because although they had suffered temporarily, they believed next year, or at least the year after, there would be a big boom in electrical supply, due to the large extension which would come from this metallic-filament lamp, for mains would be carried into districts which hitherto had been considered as out of the region of electric supply. Taking it all round, the directors of the company were very glad to have seen the last of 1908, for they looked forward to better times. The earlier part of the year did not give much hope of the future, but recently there had been a distinct improvement. The demands from their old customers were increasing, and there was a decided movement towards extension elsewhere. The London orders began to show most excellent business. On the Continent, where they had carried out no inconsiderable amount of work in the past few years, things had been, if possible, worse than in England. In the latter part of 1908 there was a bitter warfare between the manufacturers of electrical plant, and work was undertaken at prices which were shocking. It was not a question of leaving any profit, but of how little the loss would be. Still, things had improved on the Continent. The warfare seemed to have died out, and better conditions prevailed and the prospects there were decidedly better. They had recently received some very good orders, which, if they did not show much profit, were yet useful adjuncts to their business at Erith and Leigh. In the Colonies there was a certain amount of promise, and in the past year their trade with Australia was better than for many years. There

was a very decent business in South America, and elsewhere throughout the world there was a fair amount of general orders to be had—it was the price which was bad. Still, with all these complaints, they had laid an account before the shareholders which was not so bad. They had been assisted by the excellent results they had had from the Anchor Cable Co. When they first took over that company it gave them a great deal of bother, and it was only after five years of hard work that they got it into the excellent position it had now reached of being a profit-earning concern. The St. Helens Cable and Rubber Co. had not got into that happy position yet, but they were working at it, and he hoped at no very distant date that they would have equally good results. They had expended a considerable sum of money for new plant and machinery, and had had to build a new testing station. Both municipal and Government engineers were constantly adding to the burdens they put upon them in their specifications, and whereas a few years ago they thought themselves very clever people if they made a cable which stood 10,000 volts, they had now to meet 10 times that pressure, and constantly made cables which were tested at 100,000 volts. They did not now look upon 50,000 volts as anything. As to the point raised by Mr. Bain, the increase in the item of investments in other companies was more of a book item than anything else, and was a transfer from debtors. In the course of their business they were obliged to take deferred payments and give great facilities to their customers. In the past that money had been put in the general debtor account, but the auditors thought it better to place any amounts which were hung up, even although it was only for a short period, under the heading of their investment account.

The retiring directors and auditors were re-elected.

An oil painting of Mr. Callender, the founder of the company, was on view in the hall. It is a copy of a painting in Mr. T. O. Callender's possession, which the shareholders decided should be executed and hung in the board room of the company.

Johnson & Phillips, Ltd.

The annual meeting was held on Thursday of last week at Winchester House, E.C., Mr. R. W. Blackwell presiding.

In moving the adoption of the report (see Electrical Review, May 21st, page 855), the Chairman said that there was a total deficiency on the year's working of £6,192. They had to remember, however, that £13,592 had been placed to reserves, and a sum of £14,820 had been paid in respect of redemption of debentures. In addition, out of the profits of the company a sum equal to 10 per cent. of the property of the undertaking was now placed to depreciation, £16,471 had also been spent in the maintenance of the buildings, plant, &c. During the past year a further sum of £13,090 had been expended on additions to the buildings, &c. The fall in the company's profits was largely due, if not wholly due, to the absence of any orders, or any enterprises connected with the electrical industry. The cable business of the company, which for many years had been the backbone of the concern, had been well maintained. It was the directors' belief that the cable side of the undertaking would continue to prosper, and it already showed signs this year of being very much in excess of what it was during the past year. The sole trouble had been the tremendous stagnation in the whole of the electrical industry, and that company had taken their share in that ill fortune. So far as the directors could foresee, they believed the present year would be a better one for the company. They could not say definitely that it would be so, but the work now in hand was much more lucrative, and there was more of it than they had at the corresponding period last year. They had been able to cut down the expenses, and they believed that the company was in a sound position. They could say, as giving some suggestion for the future, that such export work which the company now had in hand had produced very good results. They would shortly put on the market an arc lamp invented by Mr. Brockie, from which they expected to get good results.

Mr. J. D. Bonner seconded the motion.

Replying to the shareholders' criticisms, the Chairman said that there had not been any individual loss of any magnitude nor any special thing that had changed the ordinary business of the year. They, like all other companies, had suffered from the electrical depression. With regard to the remarks as to their paying large dividends last year, he could only say that the board believed at that time that they were justified in their action. As a matter of fact, the business done in the last month of that year—he referred to 1907—was the heaviest which the company had ever experienced. As to the sum paid for extensions, £13,090—no doubt that was a large sum, but the work on which that money was expended was part of a programme laid down in 1906, and which had advanced so far that it could not be substantially checked. He might say so far that under £100 had been spent on capital account this year, and he did not anticipate there would be any large expenditure under that head.

The report was adopted.

Aron Electricity Meter, Ltd.

The report of the directors for the year ending March 31st, 1909, states that the profit and loss account for the year, after providing for general charges and depreciation, shows a net profit of £20,068, making, with the balance brought forward from last year of £3,971, a total available profit of £24,039. Out of this amount the directors distributed in December last a dividend of 3 per cent. on the preference shares, absorbing £3,747, leaving to be disposed of, the sum of £20,292. The directors recommend the payment of a further dividend of 7 per cent. on the preference shares, amounting to £8,743, and a transfer to the reserve towards goodwill and patents of £5,000, leaving to be carried forward the balance of £6,549. The directors say that business continues to their satisfaction in all branches. The factories in Schweidnitz and Paris are being increased to meet the growing demand for the company's manufactures. The taximeter business continues to develop. Up to the present it has made considerable demands on the capital of the company, as shown by the increased stock in the balance-sheet, and it is hoped that before long the results will justify the policy of the board.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Anglo-Argentine Tramways Co., Ltd.—169,406 5 per cent. cumulative third preference shares of £5 each, fully paid, Nos. 1,330,008 to 1,549,413.

To appoint a special settling day in:—

Hurst, Nelson & Co., Ltd.—20,000 6 per cent. cumulative preference shares of £10 each, fully paid, Nos. 1 to 20,000.

Java Rubber Plantations, Ltd.—6,000 vendors' shares of £1 each, fully paid, Nos. 1 to 6,000.

And to allow the following securities to be quoted in the Official List:—

Anchor Cable Co., Ltd.—£50,000 4½ per cent. debenture stock.

British Aluminium Co., Ltd.—Further issue of 39,070 ordinary shares of £5 each, fully paid; and 39,070 7 per cent. cumulative preference shares of £5 each, fully paid.

Central Electric Supply Co., Ltd.—Further issue of £63,124 4 per cent. guaranteed debenture stock.

Gateshead and District Tramways Co.—13,500 ordinary shares of £10 each, fully paid, Nos. 1 to 37, 41, 43 to 2,227, 2,229 to 5,121, 5,123 to 6,957, 6,975 to 6,994 and 6,997 to 13,528.

West Kootenay Power and Light Co., Ltd.—Further issue of £68,200 first mortgage 6 per cent. 35-year sinking-fund gold bonds for £100 each, Nos. 2,401 to 3,082.

Midland Electric Corporation for Power Distribution, Ltd.—The accounts for the year ended December 31st, 1908, according to the *Financial Times*, show a loss of £11,517, increasing the debit balance to be carried forward to £82,602.

Siemens Bros. & Co., Ltd.—The *Financial Times* reports that the directors recommend a dividend of 4 per cent. (4s. per share) for the year; £2,528 has been written off shares in other companies and £3,459 carried to pension fund.

Prospectus.—*Bombay Electric Supply and Tramways Co., Ltd.*—The list is to close to-day, June 4th, in an issue of £150,000 5 per cent. second mortgage debentures at 94½ per cent. The proceeds of the issue are required in connection with impending increase and rearrangement of the generating plant, extensions of mains, rolling stock additions, and other developments necessitated by the company's increasing business.

Companies to be Struck off the Register.—The following companies are to be struck off the Register within three months unless cause be shown to the contrary:—

Anglo-Iberian Electric Light and Power Co., Ltd.
Carl Oppermann Electric Carriage Co., Ltd.
Electric Carriage and Storage Co., Ltd.
London Electric Supply (Joint Committee), Ltd.

Para Electric Railways and Lighting Co., Ltd.—Sir W. Evans-Gordon presided at the annual meeting held at 20, Birchin Lane, E.C., on 26th ult. In moving the adoption of the report, he said that the accounts dealt with the year ended November 30th, 1908, but as mule-drawn cars only disappeared in June, 1908, the full effect of electric traction could not be judged from the accounts. For the year to November 30th last the gross receipts of the tramways branch were £139,609, compared with £137,098 for the previous year, and of the lighting branch £65,802, compared with £67,485, making a total of £205,311, compared with £204,583. The expenses were £152,637, compared with £162,951, leaving a profit from working of £52,674, compared with £41,632 for the year ended November 30th, 1907. The gross receipts, both from the tramway and lighting service, remained almost stationary. The net returns were, however, better by £11,000. The reduction of working expenses has occupied the close attention of the board and the management in Para. The construction period being over, and all outstanding questions between the different parties interested having been settled, they obtained expert and independent opinion on the manner in which the contract had been carried out, and on the best means of economically operating the system and the future prospects of the business. Mr. Laffin, till recently manager of the Manila Electric Railroad and Lighting Corporation, spent seven weeks in Para and went very thoroughly into every detail of the business. During four months ending in February last economies were effected representing a saving at the rate of over £18,000 per annum, without any sacrifice in efficiency or in the amount of work done in maintenance of the undertaking. Mr. Hubert Ansell seconded, and the motion was carried unanimously.

France.—The report of the Compagnie Continentale Edison, of Paris, for the last financial year, shows a profit of £170,400, as compared with £144,659 in the preceding 12 months. A dividend of £4 12s. 6d. per share is being declared.

Germany.—The Dantzig Elektrischer Strassenbahn Gesellschaft, of Dantzig, is declaring a dividend of 6¼ per cent. for the last financial year.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
†Aberdeen	May 19	1,949	— 142	51	68,658	— 175	..	..
Ayr	,, 29	513	— 48	..	..	..	8	..
Bath	,, 26	1,845	+ 185	21	14,110	+ 649	..	..
Belfast	,, 28	7,750	+ 315	8	31,882	+ 1,092	37	..
Birkenhead	,, 30	3,088	— 52	8	8,955	— 280	13·62	..
Birmingham Corp.	,, 22	12,869	+ 53	8	49,011	+ 489	..	..
Blackburn	,, 26	2,163	— 97	8	10,301	+ 73	13·97	..
Blackpool-Fleetw'd	,, 29	846	+ 109	21	7,147	+ 766	..	..
Bolton	,, 30	4,664	— 107	9	20,838	— 97	26	..
Bournemouth	,, 26	3,019	+ 73	8	13,411	+ 200	21·96	..
Bradford	,, 22	9,516	+ 5	8	38,407	+ 749	54·9	..
Brighton	,, 30	1,889	+ 159	8	7,889	+ 731	9·6	..
Bristol	,, 28	10,931	+1,078	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 21	447	— 6	20	4,301	— 78	3·65	..
Barnsley	,, 21	334	— 27	,,	3,296	— 97	..	..
Barrow	,, 21	425	— 14	,,	4,141	— 290	5·37	..
Cavehill	,, 21	197	— 1	,,	1,880	— 166	..	..
Devonport	,, 21	708	— 177	,,	7,313	— 1,292	8·85	..
Gateshead	,, 21	1,955	+ 5	,,	19,505	— 98	11·25	..
Gravesend	,, 21	393	+ 23	,,	3,692	— 145	6·5	..
Greenock	,, 21	1,197	+ 114	,,	9,717	+ 21	7·25	..
Hartlepool	,, 21	448	+ 8	,,	4,074	— 108	6·72	..
Kidderminster	,, 21	189	— 9	,,	1,716	— 66	..	..
Leamington	,, 21	321	+ 28	,,	2,984	+ 208	..	..
Merthyr	,, 21	416	+ 7	,,	4,076	+ 4	2·9	..
Metropolitan	,, 21	12,445	+ 306	,,	113,032	+11,980	22	..
Middleton	,, 21	694	— 55	,,	6,230	— 295	8·5	..
Mid. Joint Com'tee	,, 21	11,148	— 292	,,	107,964	— 2,515	..	..
Oldham—Ashton	,, 21	1,113	— 97	,,	10,835	— 758	9·13	..
Peterborough	,, 21	217	— 35	,,	2,058	— 139	5·31	..
Potteries	,, 21	3,559	— 17	,,	34,908	— 1,186	29	..
Rothesay	,, 21	303	— 2	,,	1,674	— 19	2·75	..
Southport	,, 21	570	+ 11	,,	4,844	+ 124	8·17	..
S. Metropolitan	,, 21	1,563	— 126	,,	14,161	+ 234	..	..
Swansea	,, 21	1,847	+ 96	,,	17,723	+ 446	12·5	..
Tynemouth	,, 21	376	— 2	,,	2,958	— 80	3·75	..
Weston-s-Mare	,, 21	212	+ 48	,,	1,046	+ 152	8	..
‡Worcester	,, 21	536	— 10	,,	4,907	— 8	5·75	..
Wrexham	,, 21	187	— 11	,,	1,854	— 59	..	..
Yorks. Wool. Dist.	,, 24	1,839	— 11	,,	17,160	— 481	17	..
Miscellaneous	,, 21	389	— 14	,,	3,719	— 4	..	..
Burnley	,, 29	2,485	— 38	..	..	..	..	..
Burton-on-Trent	,, 30	541	+ 19	9	2,2 8	— 6	6·62	..
Bury	,, 30	2,315	— 106	8½	10,386	— 202	22·6	..
Cardiff	,, 22	4,148	+ 12	8	15,988	..	..	..
Carlisle	,, 29	348	+ 5	21	3,228	— 41	..	..
Chatham and Dist.	,, 27	1,613	— 87	21	15,552	+ 1,255	14·98	2·77
Cork	,, 27	811	— 205	21	7,940	— 893	..	..
Croydon	,, 28	2,868	+ 131	..	10,869	+ 449	11·25	4·75
Darlington	,, 29	393	— 11	9	1,659	— 101	..	..
†Darwen	,, 21	243	— 10	7	1,855	— 74	4·86	..
Dover	,, 22	374	+ 2	8	1,440	+ 8	4·75	..
Dublin	,, 28	10,956	— 69	..	105,570	+ 1,083	54·25	..
Dundee	,, 26	1,298	+ 7	1½	1,789	— 153	15	..
East Ham	,, 29	2,060	+ 318	8½	8,588	+ 1,515	8·48	·68
Exeter	,, 28	871	+ 253	9	2,526	+ 352	5·5	..
Glasgow	,, 29	36,115	— 392	..	884,587	—16,437	90·5	1·5
Hastings	,, 27	1,852	— 69	..	..	..	..	..
†Huddersfield	,, 15	1,557	— 29	6	10,829	+ 469	..	..
Hull	,, 29	4,903	+ 153	8	18,444	— 86	18	..
Ilkeston	,, 26	254	— 45	8	1,036	— 93	..	..
†Ipswich	,, 22	370	— 19	8	2,748	+ 88	10·5	..
Kilmarnock	,, 22	340	— 7	52	7,762	+ 304	4·25	..
Lan'kshire Trm. Co.	,, 27	2,521	— 168	21	25,955	— 1,583	17·62	1·18
Lancashire United	,, 26	2,583	— 244	21	26,133	+ 98	..	..
Leeds	,, 22	13,125	— 157	8	49,782	+ 2,399	96·75	·25
Leicester	,, 21	2,262	— 54	..	..	..	..	..
Leith	,, 22	1,168	+ 123	51	36,889	+ 175	6	..
Liverpool	,, 22	21,257	— 507	20½	211,690	— 1,326	104	..
†L.C.C.	,, 15	70,514	+2,938	..	229,856	+19,848	121	4·25
London United	,, 29	13,697	—1,936	..	116,043	— 7,361	..	..
†Lowestoft	,, 21	164	— 9	34	4,714	— 569	..	..
†Manchester	,, 22	14,979	— 570	8	112,854	— 1,963	90·5	6
†Newcastle	,, 22	5,790	+ 147	7	29,061	+ 140	..	..
†Newport	,, 22	639	+ 4	8	5,163	+ 34	14·5	..
†Oldham	,, 23	1,900	— 101	8	16,527	— 742	23·75	..
†Pontypridd	,, 22	414	+ 88	7½	3,288	+ 596	5·5	1·75
Portsmouth	..	..	..	..	..	..	14·5	..
Preston	,, 26	1,421	— 8	..	..	..	..	..
Rotherham	,, 27	1,182	— 49	8	4,922	— 92	10	·66
Salford	,, 24	8,811	— 463	7½	35,129	— 480	..	..
†Sheffield	,, 23	5,627	— 67	8½	47,088	— 506	57	1·25
Southampton	,, 26	2,018	+ 560	8	8,142	+ 205	..	..
Southend-on-Sea	,, 12	788	+ 99	6	2,631	+ 517	..	..
†South Shields	,, 22	526	— 1	..	4,029	+ 139	..	..
Swindon	,, 26	255	— 85	..	..	..	..	..
Tyneside	,, 21	828	+ 61	21	8,404	+ 638	..	..
Wallasey	,, 29	1,829	+ 42	8½	7,809	+ 463	..	·22
Walthamstow	,, 29	1,366	— 47	9	5,670	+ 514	9	..
West Ham	,, 20	4,558	+ 110	7	16,766	+ 1,389	15	·3
Wolverhampton	,, 26	1,514	— 89	8	6,320	— 349	12·5	..
Baker St.-Waterloo	,, 29	6,400	+ 685	21	70,110	+ 5,945	4·25	..
Cen. London Rly.	,, 29	11,549	—2,046	21	115,693	—12,001	6·32	·55
Char. +, Eus. Hamp.	,, 29	7,845	+1,210	21	81,025	+13,666	7.75	..
City & S. Lon. Rly.	,, 30	6,198	+ 515	21	68,437	+ 938	7·8	..
Dublin-Lucan Rly.	,, 28	283	+ 21	21	2,500	+ 201	7	..
G.N. and City Rly.	,, 29	2,791	+ 318	21	31,961	— 3,849	3·5	..
G.N., Py. & Brmm.	,, 29	11,360	+ 600	21	121,550	+ 7,720	9·25	..
L'pool Overh'd Rly.	,, 30	2,660	— 367	21	28,586	— 2,122	6·8	4·3
Llandudno-Col. Bay	,, 28	882	+ 161	26	8,649	+ 1,896	..	..
Mersey Railway	,, 29	3,901	+ 214	21	41,265	+ 1,946	4·5	..
Metropolitan Rly.	,, 30	32,867	+1,658	21	332,565	+10,529	24·5	..
Met. District Rly.	,, 29	20,921	+2,129	21	205,447	+18,579	24	..
Anglo-Argentine	,, 27	78,271	+2,780	21	827,917	+44,496	..	..
§Auckland	April 23	18,936	+2,158	16	55,760	+ 6,877	23·3	3·1
Bombay (B.E.T.)	,, 29	5,043	+ 367	17	43,606	+ 3,025	..	..
§Brisbane	April	15,580	+1,070	..	..	..	..	..
Calcutta	May 29	6,379	+ 668	..	..	..	..	..
§CapeElectricT.Ld.	March	13,179	..	..	..	..	..	..
§Kalgoorlie, W.A.	April	3,570	..	17	£14,876	..	20·5	..
Madras	May 31	1,074	— 135	21	12,072	— 20	..	..
§Melbourne	April	47,000	..	..	..	..	..	..
§Lisbon	March	25,736	..	..	..	..	..	..
Perth (W.A.)	May 28	2,723	— 97	21	80,642	— 98	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

BUSINESS is set so strongly in the area of speculation that the investment side of Stock Exchange markets has, perforce, to take a back seat. Consols, moreover, are dull and depressed, and there is no spring in any of the gilt-edged sections. The remarkable boom in African Mining shares absorbs most of the interest, and most of the energy, in Stock Exchange circles. As regards the markets dealt with here, the feature has been the movements in the Mexican-Canadian group.

Nominally, the slump in these last-named was due to a severe drought in Mexico. Dr. F. S. Pearson, however, cabled reassuringly, and prices recovered substantially. The Mexican issues are the most affected, the light and power and the tramways descriptions falling several points before they rallied. Canadian General Common stock declined to 121½, and the Preference to 121. Monterey First Debenture is dull at 91½.

Rio Trams dropped sharply to 102 and then recovered, moving in sympathy with the Mexican prices. The 5 per cent. First Mortgage bonds fell 1½ to 96½, and the Seconds shed 2 to 86½. Sao Paulo shares are fairly steady at 157. A slump in the securities—for one reason or another—was nothing to be surprised at. Prices have had such a run up that as soon as the "shop" chose to withhold support, a drop became assured. Speculation, be it repeated, has now roared into mining shares, and the former channels are deserted in favour of the most recent scenes of activity.

The Home Railway market is somewhat undecided, as a whole. Dividend period is approaching, but the hopes of distributions for the current six months are not running high. Only the Underground lines are expected to show up well, and the anticipation of better things has been steadily rising, with quotations, for the past month or two. Just lately reaction has set in, and Metropolitan again displays a small decline, while District Ordinary remains dull at 16⅜. Central London Deferred fell 1; City and South London is unchanged. East London commands further interest, and the price has moved up to 3⅝. The most conservative of financial scribblers might be pardoned for the suggestion that, as a sheer gamble, East London Ordinary stock, £100 nominal for, say, 75s., could hurt nobody who cared to risk some small sum which might either double in value or be lost. That something must be done one day for the benefit of the line is tolerably certain. There is a Second Debenture stock standing at 24. For last year it received 7s. 6d. in dividend.

Electricity Supply shares are quiescent as ever. The only movement in the London group is ⅛ rise in St. James' and Pall Mall Ordinary, which makes the price 9¼. Central Electric Debenture is marked *ex* dividend, which accounts for the 2 points that the price has been put down. Provincial shares are as motionless as the London varieties, and the list can only be described as extremely uninteresting.

Anglo-Argentine Trams have eased off a little, and London United Tramways continue very depressed. The brilliant Whitsun weather sent hundreds of thousands to the company's cars, but it will require something in the way of a miracle of traffics to compensate for the financiering which has landed the London United into its present condition.

For Eastern Extension shares to ease off while Eastern Telegraph Ordinary improved is certainly a little anomalous, and it would appear as though holders of the shares were exchanging into the stock. The 18s. on account of dividend arrears came off West India and Panama Second Preference last week, and the price is quoted ¾ lower at 8½. The First Preference, *ex* 6s. dividend, are 9, and the 5 per cent. First Debentures gained a point. Anglo-American Telegraph Deferred has given way, although the American Railroad department keeps very hard.

Castner-Kellner shares are good, business being done at 38s. 9d. *ex* the dividend of a shilling. Willans & Robinson Ordinary slipped back a little. There is not much doing in any Industrials except rubber shares, where the market continues to be strong and buoyant, occasional relapses being followed by substantial recoveries.

Reduction of Capital.—Frederick Smith & Co., wire manufacturers, Limited and Reduced.—A petition for confirming a resolution for reducing the capital from £200,000 to £115,000, is now pending. The proposed reduction is the result of the recent sale of the Salford branch of the company's business, whereby a large part of the capital embarked in that branch is no longer required for the purposes of the Halifax business.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations May 25th.	Closing Quotations June 1st.	Business done week ended June 1st, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	£10	Nil	Nil	Nil	Nil	2⅞ — 3¼	2⅞ — 3¼	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,360 Red.	£100	5 %	5 %	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 0
$121,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7¾%	8 %	8 %	8 %	142 —143	143½—144½	144½	..	+ ½	5 10 9
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	98½—100½	98½—100½	..	..	..	3 19 7
698,180	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	58 — 60	58 — 60	..	..	..	5 5 7
3,200,910	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101½—102½	101 —102	102½	101½	— ½	5 17 8
3,200,910	Do. do. Deferred	Stock	1½%	12½%	1 %	8/-	17⅞— 17⅞	16⅞— 17⅛	17 7/8	16 1/2	— ⅛	2 6 0
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99 —101	99½—101½	..	..	+ ½	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	8¼	..	..	4 15 6
2,431,350	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	91⅛— 93½	91⅛— 93½	92⅛	91⅛	..	4 5 7
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8½ — 9	8½ — 9	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	2⅞— 3⅜	2⅞— 3⅜	..	..	..	5 3 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8¾— 9	8⅝— 9	..	..	..	5 11 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 16 6
60,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	12⅜— 13½	12⅜— 13½	..	..	..	6 8 4
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	133 —135	134½—136½	135⅝	134½	+1½	5 2 7
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	8½%	85¼— 87 xd	85½— 87	86¼	86⅜	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 — 105	103 —105	..	..	..	3 16 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	12½— 12⅝	12½— 12⅝	12 7/8	12½	— ⅛	5 12 0
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101½—103½	101½—103½	..	..	..	3 17 4
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	£5	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 8
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10⅜— 11½	10⅜— 11½	11	10⅞	..	5 3 11
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	..	12⅜— 13½	12⅜— 13½	13½	12 1/8	..	4 10 7
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18%	27 — 28	27 — 28	..	..	..	6 8 7
14,800‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
17,000	Indo-European Telegraph	£5	13 %	13 %	13 %	13 %	51½— 53½	51½— 53½	..	..	..	6 1 6
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	78 — 82	78 — 82	..	..	..	4 17 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	73 — 76	73 — 76	..	..	..	5 5 8
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜— ½	⅜— ½	19/6	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	£1	5 %	6 %	6 %	6 %	¾— 1	¾— 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	£1	5 %	5 %	5 %	5 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	5 12 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 —108½	107⅝	107	..	5 10 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	123½—124½	123 —124½	123⅝	123	— ½	4 16 5
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅝— 11	10⅝— 11	..	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10⅝— 11	10⅝— 11	..	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅞	5⅜— 5¼	5⅜	..	..	4 5 1
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 0
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	£1	7 %	7 %	8 %	8 %	1⅝— 1⅞	1⅝— 1⅞	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref...	£1	6 %	6 %	6 %	6 %	1⅜— 1⅝	1⅜— 1⅝	..	..	..	5 1 1
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	88½	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,889‡	Reuter's	£	5 %	5 %	5 %	5 %	7⅞— 8¼	7⅞— 8¼	..	..	— ⅛	4 14 9
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100—102	100½	..	..	4 8 3
3,068	Submarine Cables Trust	Certs.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
120,000	United River Plate Telephone	£5	8 %	8 %	8 %	..	6⅞— 7⅞	6⅞— 7⅛	7 1/8	..	..	5 12 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	£5	5 %	5 %	5 %	5 %	5 — 5⅝	5 — 5⅝	..	..	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1¼— 1⅜	1¼— 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13½— 13⅞	13⅞— 14⅛	14	13 7/8	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜— ½	⅜— ½	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	9 — 9¼	8¾— 9⅛	8 11/16	..	— 1/16	6 6 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8¾— 9¼	8 — 9	..	..	— ½	..
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	103 —104	..	..	+1	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	£5	8 %	8 %	9 %	10 %	9⅜— 9⅞	9⅜— 9 13/16	9⅞	9 21/32	..	5 0 8
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	£5	5½%	5½%	5⅞%	6 %	6⅛— 6⅜	6⅛— 6⅜	..	..	..	4 14 1
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	94 — 96	94 — 96	95	..	..	4 6 6
450,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —104	103 —104	..	..	..	4 16 2
880,000	Babcock & Wilcox, 1 to 880,000	£1	20 %	20 %	20 %	20 %	4⅞— 4⅞	4⅞— 4⅞	91/8	8 29/32	— 1/32	4 8 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	£1	6 %	6 %	6 %	6 %	1⅛— 1⅛	1⅛— 1⅛	..	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	£5	7 %	7 %	7 %	7 %	1⅝— 1⅞	1⅝— 1⅞	..	..	..	25 2 0
60,000	Do. do. 7 % Cum. Pref.	£5	7 %	7 %	7 %	7 %	2 — 2⅛	2 — 2⅛	..	..	..	14 0 0
40,100	Do. do. "A" 6 % Cum. Pref. ..	£5	6 %	6 %	6 %	6 %	3¾— 4	3¾— 4	70/-	..	..	7 10 0
12,897	Do. do. 4 % Funding Certs.	£5	4 %	4 %	4 %	4 %	3¾— 4¼	3¾— 4¼	..	..	..	4 8 11
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 —100	95 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	142 —146	142 —146	..	..	..	5 9 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	123 —127	123 —127	..	..	..	4 14 6
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	109 —112	..	..	..	4 9 2
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 8 6
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	103 —105	102 —105	..	..	..	4 5 9
188,301	British Electric Traction	10	3 %	Nil	Nil	..	⅜— 1⅛	⅜— 1 1/16	17/6	..	— 1/16	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	..	2⅜— 3⅜	2⅜— 3⅜	..	..	..	8 17 9
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	89 — 93	89 — 93	92⅛	..	..	5 7 6
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 72	68 — 72	..	..	..	6 5 0
100,000	British Insulated and Helsby Cables	£5	8 %	10 %	10 %	10 %	7⅜ — 7⅞	7⅜ — 7⅞	7 11/16	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	£5	6 %	6 %	6 %	6 %	6⅜ — 6⅝	6⅜ — 6⅝	..	..	..	4 7 8
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
204,947‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	£5	Nil	Nil	Nil	Nil	½— ¾	½— ¾	..	..	..	Nil
1,016,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	40 — 44	40 — 44	..	..	..	9 1
60,000	Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅞— 1⅛	⅞— 1⅛	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	£2	2½%	Nil	Nil	Nil	0 — ¼	0 — ¼	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	£2	6 %	Nil	Nil	Nil	0 — ¼	0 — ¼	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	43 — 48	43 — 48	..	..	..	9 8 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	29 — 33	29 — 33	..	..	..	13 12 8
187,610	Calcutta Trams, 1 to 187,610	£5	8 %	8 %	6 %	..	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	6 6 4
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,380..	£5	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 15 8
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	100—103	100 —103	..	..	..	4 7 5
35,000	Callender's Cable Construction shares	£5	15 %	15 %	15 %	..	9⅜— 10⅜	9⅜— 10⅜	10⅛	10 1/8	..	7 4 7
40,000	Do. do. 5 % Cum. Pref.	£5	5 %	5 %	5 %	..	5⅛— 5⅝	5¼— 5⅝	..	..	..	4 8 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E. Trams., 1 to 491,222	£1	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	£1	6 %	8 %	12 %	..	1⅛— 1⅜	1⅛— 1⅜	30/8	38/9	..	6 0 7
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	102 —106	102 —106	105	104½	..	4 4 11
1,893,610	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	68 — 70	68 — 70	70	..	..	4 12 10
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	56 — 57	56 — 57	..	..	..	4 12 0
553,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	52 — 54	51 — 53	..	..	—1	4 16 2
1,480,000	City and South London Railway	Stock	13%	25%	3½%	1½%	31½— 32½	31½— 32½	32½	32	..	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	£	2½%	5 %	5 %	5 %	1 — 1½	1 — 1½	..	..	..	9 7 6
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	95 — 98	95 — 98	..	..	..	5 2 0

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1906.	1907.	1908.	Closing Quotations May. 25th.	Closing Quotations June 1st.	Business done week ended June 1st, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1⅛ — 1⅝	1⅛ — 1⅝	..	..	— 1/32	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 31/32 — 2 1/32	1 31/32 — 2 1/32	..	..	..	4 16 0
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	4½%	4½%	..	¼ — ⅜	¼ — ⅜	..	..	..	25 0 0
17,189	Do. "A" shares, 01—017,189	5	4½%	4½%	4½%	..	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	70 — 75	70 — 75	..	..	..	5 6 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	4 %	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	9	Nil	Nil	Nil	Nil	3/32 — 1/8	3/32 — 1/8	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	9	7 %	7 %	7 %	7 %	⅛ — 1/32	⅛ — 1/32	..	..	..	11 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7⅛ — 7⅜	7⅛ — 7⅜	..	..	..	6 9 0
300,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
75,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 75,000	10	4 %	4 %	1½ %	Nil	⅜ — ½	⅜ — ½	..	..	..	6 13 4
95,000	Greenwood & Bailey, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10⅜ — 10⅝	10⅜ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11⅝ — 12⅜	11⅝ — 12⅜	11⅞	..	..	6 1 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 5 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	104 —106 xd	..	..	..	4 5 9
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	10 %	10 %	..	14½ — 15½	14⅜ — 15½	15	14 1/16	— ⅛	6 11 2
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	¾ — 1	¾ — 1	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	1⅝ — 2⅛	2 — 3	..	..	+ ⅛	4 8 11
399,930	Do. do. 50,008 to 100,000	10	3 %	3 %	3 %	Nil	3 — 4	3⅛ — 4	..	..	+ ⅛	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3⅜%	2⅛ — 3⅛	2⅛ — 3⅛	..	..	..	11 10 10
1,361,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	70 — 74	70 — 74	..	..	..	5 8 1
5,782,052	Metropolitan Consolidated	100	2½%	1 ½%	1½%	½%	39 — 39½	38⅝ — 39½	39½	38 1/16	— ⅛	1 5 5
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	70 — 72	70 — 72	70 5/16	70⅛	..	3 16 5
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	16½ — 17	16½ — 17	16 7/16	16½	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	⅜ — ½	⅜ — ½	..	..	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	1/- — 1/3	1/- — 1/3	1/-	9d.	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	15/3 — 15/6	15/3 — 15/6	15/3	..	..	6 19 5
600,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99	98½	97½	..	4 10 11
$6,000,000	Mexico Trams Co., Common Stock	..	..	..	..	..	151 —152	148 —150	152½	148	—2½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	96½ — 97½	95 — 96	96½	95½	—1½	5 4 2
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	⅞ — 1	⅞ — 1	..	..	..	8 13 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	½ — ¾	½ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	88 — 91	86 — 89	..	..	—2	5 1 2
87,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	15 %	83½ — 84	83½ — 84	83½	..	..	6 0 0
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	101	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	101 —102	101½—102½	101⅞	101⅝	+ ⅜	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	88 — 90	88 — 90	89⅜	..	..	5 0 0
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	86 — 88	86 — 88	87½	87 7/16	— 7/16	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	Nil	Nil	10 %	Nil	⅜ — ⅞	⅜ — ⅞	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 126,001 to 141,666	1	Nil	..	6 %	6 %	2⅜ — 3⅛	2⅜ — 3⅛	60/-	..	— 1/3	7 15 6
246,404	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	78 — 82	78 — 80	..	..	—2	5 0 0

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
30,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 30,000	5	10 %	10%	10 %	10 %	8½ — 9	8½ — 9	8⅝	..	..	5 11 1
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	97 —100 xd	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞ — 4⅛	3⅞ — 4⅛	78/9	..	..	5 14 3
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4¼	4⅛ — 4¼	..	..	..	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4¼	3⅞ — 4¼	81/3	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	..	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅜ — 11	10⅜ — 11	10⅞	10 1/16	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅛ — 12⅛	11⅛ — 12⅛	..	..	..	4 16 0
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —123	121 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3¼ — 3½	3¼ — 3½	..	..	..	6 13 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	96 — 98	96 — 98	..	..	..	5 2 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8⅜ — 8⅞	8¼ — 8⅝	8⅝	..	— 1/16	5 14 3
50,997	Do. do. 6 % Pref., 40,001—90,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅜	10⅜ — 11⅛	10 5/16	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	5/8 — ¾	5/8 — ¾	14/6	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	60 — 63	60 — 63	..	..	..	7 2 10
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	88 — 90	89 — 91	89½	..	+1	5 9 11
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 5	4½ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5¼	5 — 5¼	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 11
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅞ — 7⅞	7⅞ — 7⅞	..	..	..	5 9 8
$2,400,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	99 —101	99 —101	100⅛	100⅛	..	5 4 11
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7⅛ — 7⅜	7⅛ — 7⅜	..	..	..	6 1 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5⅜	5⅛ — 5⅜	5 3/16	..	+ 1/16	5 11 8
574,595	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 96	92 — 96	..	..	..	4 3 4
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4⅜ — 4⅝	4⅜ — 4⅝	91/3	..	..	5 5 3
75,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	96/10½	..	..	4 5 9
230,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
248,000	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	3½%	85 — 88	85 — 88	..	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	89¼— 90⅛	86⅛— 88⅛	89	87⅛	—2⅛	5 13 0
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	76¼ — 78½	76 — 78	77⅞	75½	— ⅜	4 9 9
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	113 —115	109 —111	113½	110½	—4	6 6 2
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	92⅝ — 93⅜	87 — 89	93	87½	—5½	5 12 4
260,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	2½%	4⅜ — 5	4⅜ — 5	..	..	..	2 10 0
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	4½ — 5½	4½ — 5½	..	..	..	4 15 8
196,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,965	100	..	..	..	..	99 —101	99 — 101	..	..	..	..
10,853	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11⅛ — 12⅜	11⅛ — 12⅜	..	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6⅜	6 — 6⅜	6⅜	..	..	5 7 8
80,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1⅝ — 1⅞	1⅝ — 1⅞	28/6	..	..	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	23/-	21/9	..	5 6 8
194,684	Do. do. 6% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —107	103 —107	..	..	..	4 13 6
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅞ — 9⅛	9 — 9⅛	9 1/16	..	+ ⅛	6 13 4
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	4 13 4
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅛ — 3⅛	2⅛ — 3⅛	..	..	..	6 9 0
20,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	⅝ — ¾	⅝ — ¾	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	5 6 8
220,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 0 0
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅞ — 1	⅞ — 1	..	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	2 — 2½	2 — 2½	..	..	..	10 0 0
75,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 84	80 — 84	..	..	..	5 7 2
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	5 %	3/32 — 3/16	3/32 — 3/16	..	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	9⅛ — 9⅜	9⅛ — 9⅜	9½	..	..	6 11 2
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5⅛ — 5½	5⅛ — 5½	..	..	..	4 1 10

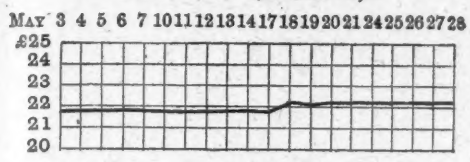
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

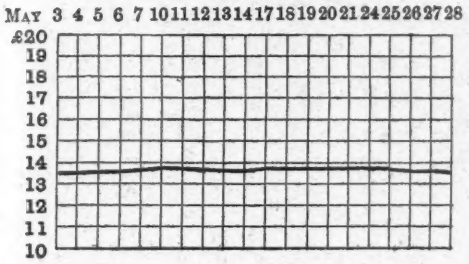
METAL MARKET.

Fluctuations in May.

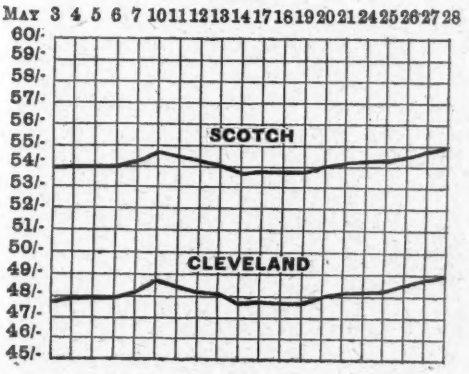
SPELTER (G.O.B's.).



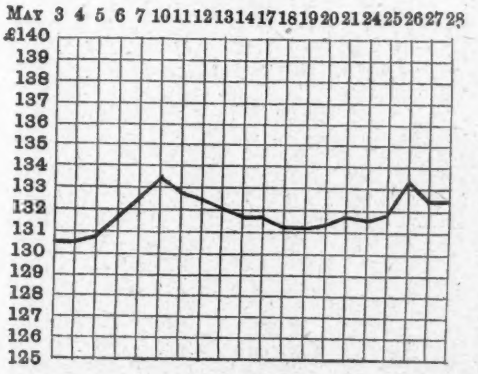
LEAD (ENGLISH).



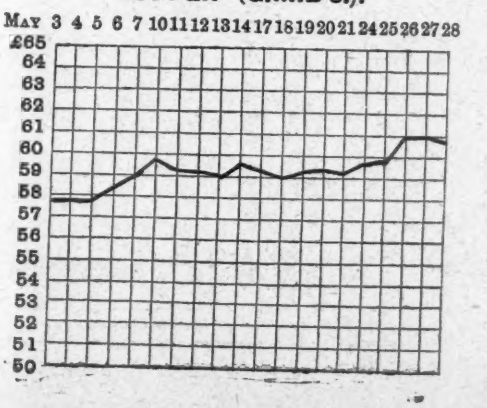
IRON.



TIN.



COPPER (G.M.B's.).



THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

Unfavourable Prospects for the Present Year.

The intention of the Victoria Falls and Transvaal Power Co. to place large orders with German firms was foreshadowed in the Review, page 485, on March 19th, in a quotation from the report of the Dresden Bank for 1908. It was then stated, according to the directors of the bank, that the allocation of the work to German companies represented a new and important success of Teutonic industry. It appears that the whole of the previous debenture issue of £800,000 was taken over in Germany, and the holders disposed of all the bonds in the market some time ago. If the further emission of £900,000 is sold just as easily, the funds for the payment of contracts should be available long before the work, in connection with which Prof. Klingenberg recently proceeded to South Africa, is completed.

The severity of competition in Germany shows no signs of abatement. Complaints on the subject are made by manufacturers, both large and small, one of the latter actually declaring that the present year will witness still more unsatisfactory results than 1908. On the other hand, the opinion of the Berlin Stock Exchange, as exemplified by the recent rise in quotations, is that the largest manufacturing companies, will be able, for the financial year ending with June, to pay dividends at the same rates as for 1907-8.

German Works.

The Bergmann Electricity Works Co., whose aspirations lie in the direction of occupying a position in the first rank of the largest manufacturing undertakings, reports having been fully employed during 1908, the invoiced goods having amounted to £1,151,500, or £100,000 in excess of 1907, which in turn exhibited an advance of £250,000 over 1906. Owing to keener competition, the sale prices realised were substantially less than in the preceding year, but it was possible to counteract these conditions by the purchase of raw materials on favourable terms and by the production in the company's own metal works of semi-finished articles at a lower rate and independently of other firms. The accounts indicate the following figures for the past two years:—

	1908.	1907.
Capital paid up	£830,500	£700,000
Gross profits...	413,790	356,250
Depreciation provision ...	65,798	67,621
Net profits	158,400	137,990
Dividend	126,000	108,000
„ per cent.	18	18

During 1908 the share capital was raised by £350,000 to £1,050,000, but the time has not yet arrived for the payment of the remaining instalments on the former. In addition, an issue of £500,000 in bonds is in contemplation, so as to provide funds for dealing with large transactions in a similar manner to that projected by the recently created electrical banks. The report gives particulars of the work accomplished by the different departments, and states that the new cable factory was started at the beginning of 1909, although only minimum profits are obtainable in view of the dissolution of the cable syndicate. The various departments occupied 5,000 workers at the end of 1908, as against 4,000 at the close of 1907.

The turnover of the Hartmann & Braun Co., of Frankfort-on-Main, was not quite of the same value in 1908 as in the previous year, and the gross profits declined from £77,024 in 1907 to £74,900 last year. On the other hand, the expenses and taxes experienced an increase, but as a less sum was provided for depreciation, the net profits only receded from £26,370 in 1907 to £25,640 in 1908. It is proposed to distribute 11 per cent. on the share capital of £85,000, as contrasted with 12 per cent. on the same capital in the preceding year. The directors' report adds that the new buildings were completed, and the relief thereby afforded to the existing workshops would permit of further branches of manufacture being undertaken. The company, which employed 621 workers at the end of 1908, states that in consequence of the competition of the large works, the prospects for the current year are not very gratifying.

The directors of the Voigt & Haeffner Co., of Frankfort-on-Main, state in their report for 1908 that the turnover in the first four months was 20 per cent. greater than in the corresponding period in the preceding year, this being principally due to orders brought over from 1907. But when these orders had been completed a decline took place, and the contracts diminished still further as the end of the year approached. In consequence, however, of the position of affairs in the early part of 1908, the turnover for the whole of the year reached the level of that in the preceding 12 months. The accounts indicate the undernoted figures:—

	1908.	1907.
Share capital...	£150,000	£150,000
Gross profits...	67,292	67,461
Net profits	31,208	34,203
Dividend, per cent.... ...	10	10

The company, whose electric light and gas installation patterns and patents, have been completely written off, owns 31 patents, of which 10 are foreign, and 106 trade designs. The directors remark

that the prospects for the current year could not be seen with certainty. As compared with the close of 1908, the orders received show no considerable reduction, although there was no mistake that the general depression is reacting unfavourably upon the electrical industry.

The shareholders in the South German Cable Works Co. (Suddeutsche Kabelwerke) approved the report and accounts for 1908 at the recent meeting, and sanctioned the amalgamation of the undertaking with the Heddernheim Copper Works. According to the directors' report, the year was, on the whole, favourable and profitable to the company. The sale prices to some extent still further receded, but the cheapening of raw materials rendered it possible to realise somewhat higher profits. The value of the turnover slightly declined, although the volume was considerably increased as larger export orders were secured. Among the items set forth in the accounts may be cited the following for the past two years:—

	1908.	1907.
Share capital...	£150,000	£150,000
Gross profits...	38,106	37,379
Working expenses	10,710	11,311
Depreciation provision ...	4,633	5,249
Net profits	23,013	21,481
Dividend, per cent.... ...	8	8

It will be observed that the working expenses were somewhat less than in 1907, and the sum of £5,000 was provided in the latter year for extra depreciation, but no appropriation under this particular heading has been made for 1908. The report adds that the downward movement in sale prices has not ceased in 1909, although the activity of the works was still comparatively good. The amalgamation with the Heddernheim Copper Works, as was recently mentioned in this journal, has rendered it unnecessary for the cable manufacturing company to install copper rolling and drawing mills, which, as shown by experience, would have experienced difficulty in disposing of the production.

The Heddernheim Copper Works (late F. A. Hesse Sohne), of Frankfort, which are being amalgamated with the South German Cable Works, delivered a larger quantity of material in 1908 than in the preceding year, but the value declined owing to the fall in the price of copper. The net profits amounted to £36,855, as compared with £26,505 in 1907. A dividend has been declared at the rate of 7 per cent. on the £50,000 of priority capital, and of 7 per cent. on the £200,000 of ordinary shares, these rates comparing with 6 per cent. in each case in 1907.

The following dividend announcements have also been made by other companies:—

	1908.	1907.
Vereinigte Isolatorenwerke, Pankow, Berlin ...	Nil	Nil
Voltohm, Seil und Kabelwerke, Frankfort-on-Main	4%	4%
Deutsche Kabelwerke, Berlin	6%	6%
Dr. Paul Meyer Gesellschaft, Berlin	7%	7%
Elektrotechnische Fabrik Rheydt, Max. Schorch and Co., Rheydt	7%	7%
Kabelwerk, Duisburg	10%	10%
Sachsenwerk, Dresden (preference shares) ...	4%	Nil
" " (ordinary shares) ...	Nil	Nil

French, Belgian and Austrian Works.

The Compagnie Française pour l'Exploitation des Procédés Thomson-Houston, of Paris, realised gross profits of £119,800 on manufacturing and £68,000 from dividends in other undertakings in 1908, making a total of £187,800. These compare with £104,680 and £72,000 and a total of £176,680 respectively in 1907, on a share capital which remains unchanged at £1,600,000. The net profits amounted to £89,840, as compared with £88,990 in 1907, and it is proposed to pay a dividend of £1 2s. per share, being the same rate as in the preceding year. During the year the loan debt was increased to £1,176,000, the total in 1907 being £788,000. The securities in portfolio advanced from £2,280,000 in 1907 to £2,651,000 in 1908, the addition being represented by preference shares in the General Parisian Tramways Co. and shares in the South-Western Electrical Energy Co. The reserve fund stands at £928,000.

The A.E.G.-Union Electrique, of Brussels, is stated in the directors' report to have experienced an increased turnover in 1908 as compared with the preceding 12 months, and notwithstanding the crisis, the effects of which were specially felt in the second half of the year, the orders on hand on March 31st, 1909, were substantially of the same value as at the corresponding period in 1908. Although the augmentation in business specially concerned tramways and central stations, the company was also able to develop work in connection with collieries, iron and steel works, and various industries. During 1908, 1,241 dynamos or motors of a total of 53,695 H.P. were sold or installed; and the installations carried out or on order, include pumping plant, five two-phase motors of from 600 to 1,800 H.P. for rolling mills, four winding engines of from 250 H.P. to 1,000 H.P., and a power-transmission scheme by means of underground cables, at 10,000 volts, over a distance of 5½ miles, so as to connect together rolling mills and blast furnaces of a metallurgical company. The company started 11 turbo-alternators of the A.E.G.-Curtis type, of a total of 15,500 H.P., in 1908, and the number ordered in the country hitherto had been 34 units of 50,000 H.P. The accounts show net profits of £11,160, and a dividend at the rate of 6·74 per cent. has been declared on the ordinary share capital of £100,000. The latter has recently been increased to £140,000, as a result of the decision that was arrived at last year to raise the capital. At the end of 1908 the company provided employment for 353 workmen and 138 engineers and officials.

The Compagnie Belge d'Electricité Siemens-Schuckert, of Brussels, realised gross profits of £11,735 in 1907-8, of which the expenses absorbed £10,160. After applying the sum of £775 to the purpose of depreciation, the balance has permitted of the payment of a dividend of 6 per cent. on £12,000, out of a total nominal share capital of £20,000. The liabilities at the close of the financial year amounted to £143,000, the greater portion of which was in respect of the parent company in Berlin.

The A.E.G. Société Générale Belge d'Entreprises Electriques, of Brussels, earned gross profits of £44,800 in 1908, as against £36,200 in the previous year, on a share capital of £320,000. The net profits were £28,860 and £29,130 in the two years respectively, and a dividend has been declared at the rate of 7½ per cent., being the same as in 1907.

The Felten & Guilleaume Co., of Vienna, realised gross profits of 3,316,000 crowns in 1908, as contrasted with 3,232,000 crowns in the previous year, and net profits of 2,567,000 crowns and 2,557,000 crowns in the same years respectively. It has been decided to pay a dividend of 17½ per cent., being at the same rate as in 1907. The directors' report states that the course of business was satisfactory, especially in the electrical department. On the other hand, the company's iron establishment in Styria suffered from unfavourable conditions, as well as from the alterations in the rolling mill. If, nevertheless, somewhat more favourable results were obtained, these were due to improved and more efficient equipment, and to the company being free from the large fluctuations in the prices of raw materials which took place in 1907.

Among other Austro-Hungarian undertakings may be mentioned the Kabelfabrik und Drahtindustrie Gesellschaft, of Vienna, which has declared a dividend of 11 per cent. for 1908; the Kabelfabrik Pressburg, 11 per cent.; the Ganz Electricity Co., of Buda-Pesth, 5 per cent.; the A.E.G.-Union Electricity Co., of Vienna, 7 per cent., as compared with 6 per cent. in 1907; the Allgemeine Austrian Electricity Co., 6¼ per cent., as against 6½ per cent.; and the Buda-Pesth Allgemeine Electricity Co., 8 per cent. in 1908, as contrasted with 7 per cent. in the previous year.

BOOK NOTICES.

La Machine à Influence. By V. Schaffers. Paris: Gauthier-Villars.—The electrical friction and influence machines, although amongst the earliest electrical generators, have received little in the way of systematic study. A few general particulars appear in most text-books, and individual types have from time to time been fairly fully investigated by their inventors or users, but little critical or comparative work has been done. The small practical importance of these machines in the past probably accounts for this, but there are now several branches of electrical work, including wireless telegraphy, in which an opening for a perfected electrostatic machine exists. A general survey of the subject, such as is given in this volume, is, therefore, fully justified. The treatment is to a great extent theoretical rather than descriptive or practical, and a large amount of experimental work, obviously, still requires to be done before a number of important points are cleared up and before the theory of these machines can be placed on a par with that of dynamo-electric machinery. There are 24 chapters, the first 11 giving descriptions and explanations of the actions of various influence machines, commencing with the electrophorus, and including particulars of Holtz's various machines, Toepler, Voss, Wimshurst, and some 20 or 30 other machines. The next nine chapters contain a generalised theory embracing these various machines and including clear explanations of the difference between direct-current and alternating-current influence machines, and of several types of electrostatic motors. The remainder of the book contains details of the various tests which have been carried out on influence machines. It will be seen that this volume forms a thorough *résumé* of the existing knowledge of a somewhat obscure subject. No index is given, and this omission certainly should be rectified.

Energy Charts for Steam.—We have received from Mr. R. M. Neilson a copy of two charts published with the issue of *Power and the Engineer* for March 16th, 1909, which show the mechanical energy obtainable from the isentropic (adiabatic) expansion of steam, that is, expansion during which the fluid neither receives nor loses heat as heat. One of the charts gives the work of expansion from initial pressures of 25 to 250 lb. per sq. in. to final pressures of 15 to 200 lb. per sq. in. The second chart is a continuation of the first, and deals with final pressures below atmospheric, the scale for final pressures being made much greater than in the other chart. Examples of the use of the charts are given thereon. Similar charts, but to a smaller scale, were first published in Neilson's work, "The Steam Turbine," in which instructions are given for correcting for superheat. No allowance for superheat was made in constructing the charts before us, owing to the want of agreement still existing as to the exact nature of the curves of variation of the specific heat of steam.

"Science Abstracts." Vol. XII, Part 5. Sections A and B May 25th, 1909. London: E. and F. N. Spon. Price 1s. 6d. each part.

"The Design and Construction of Induction Coils." By A. F. Collins. New York: Munn & Co. 1909. Price $3.00 net.

"Les Découvertes Modernes en Physique." By O. Manville. Second Edition. Paris: A. Hermann. 1909. Price 8 fr.

OUR NATIONAL INDUSTRIAL WEAKNESSES.

With Notes on the Revival of Trade.

When we are in the midst of a trade boom, we have neither time nor inclination to analyse industrial weaknesses. But of late, from a variety of causes, a pronounced slump in business has led each to search his own and the other man's heart, looking into matters which, in rosy times, he knew were unsatisfactory, but which there was then no pressing necessity to set right.

When there are big prizes for all, we pay less heed to the matter of handicaps, but with trade everywhere depressed and finance treading nervously and cautiously, the prizes at present are fewer; moreover, there are many runners, and every single yard of handicap must tell—however glorious may be the record of our past achievements, and however numerous the trophies gained and treasured.

For the foregoing reasons, the British position in the trade battle has become the subject of the conversation of every man who knows anything about industry and commerce, and, may we softly say, of some who do not. We are all well-nigh saturated with it. We cannot dine but someone brings on the unsavoury dish; we go to church, the parson prays about trade, and a collection follows for the unemployed; by every post letters are received from men who seek an appointment; we meet old friends in the city streets, and they are down on their luck. For five or six years now ever since Birmingham Halls resounded with orations foretelling decadence—after a 250-million war in a land whose trade is filched by Continental rivals—and suggesting reforms, have we been hearing and talking of failure and decay *ad nauseam*, until we are all in danger of regarding them as among the inevitable and inseparable phases of the first decade of a new century.

Here and there some optimistic spirit speaks of signs of revival in his own particular sphere, and we breathe more freely, until some dividendless body of shareholders—and there are many of them just now—approach bemoaningly, when we flounder again in our Slough of Despond.

They used to say of us that we took our pleasures sadly, but they admired the quiet determination and unruffled temperament with which we faced adversity. Our tribulations are now borne with less equanimity, and one wonders whether there is a temporary decadence of the national character when we develop such a susceptibility for scares and sensations. Back in our Slough of Despond, we resume our critical examinations, but the surroundings are not conducive of good result. This sort of experience is unhealthy for all of us. Cuddling our shrivelled souls in piteous grief, the day after we have been upon a mountain top of expectation.

The historian of these times will look back and write such things as these concerning us:—"During the early years of the twentieth century a strange change came over the temperament of these people, so many remedies had they, and so earnestly occupied were they discoursing upon them, that they applied none of them until—" Until when? What is going to happen? To discuss the prospects of a change of Government were too political a matter for the pages of this journal, and yet who, of any shade of political thought, can say that they have not added many a handicap to industry? But would a change of Government revive trade in Germany, in America, in South Africa, in Egypt, in India, in Japan? All of these, and others, too, have suffered, and we and they in a very large measure are inter-dependent.

It will be interesting to quote here a few recent statements regarding the extent of the depression and the signs of revival. In many quarters there are definite signs of improvement.

The chairman of the *Oriental Telephone and Electric Co.*, which has an interest in many Indian and other Far Eastern telephone concessions, says "the year 1908 was one of general depression in every branch of trade, and this company has not escaped being affected by it," "the beginning of the present year had been encouraging, and as trade was gradually improving in all those countries with which they had business relations, they looked forward to still better results in the present year."

Sir J. Wolfe Barry, addressing the *Eastern Telegraph Co.*, said that their falling off in traffic receipts extended over nearly every branch of the traffic. The principal reduction, however, was in their Egyptian traffic, which alone showed a decline of £11,000 for the half-year, largely owing to the cotton strike in Lancashire, this factor also being the principal cause of the decline of about £5,000 in their receipts from traffic with India.

"They hoped that the improvement in the South African traffic was an indication of the revival of the trade in that country, which had been so anxiously expected ever since the termination of the war." "The current year, so far, showed an improvement in revenue over that of 1908." No surer commercial barometer could be found than "in the study of the variations of the traffic receipts of submarine cable companies, and, perhaps, this was more marked in the case of their company, whose revenues were derived from so many of the trade centres of the world."

Addressing the *Eastern Extension Co.*, of which he is also chairman, Sir J. Wolfe Barry further said that their reduced traffic was due to the "commercial depression that had prevailed for some time past in all parts of the Far East. He was inclined to think from slight indications of improvement recently noticeable in the Straits Settlements and elsewhere, that they had seen the worst of this commercial depression, and he ventured to hope that before very long the financial situation in the countries served by their cables would improve."

The chairman of the *Calcutta Tramways Co.* said the other day, "the general state of affairs in India had decidedly improved."

Mr. Edward Dicey, C.B., in an article in the current number of the *Financial Review of Reviews* on "The Outlook for Egypt," shows how seriously Egypt was affected by the American financial panic, as was, indeed, every financial institution in the civilised world, and he sets forth various considerations, "which tend to show that the depression of trade and commerce under which Egypt has suffered recently is not likely to be permanent."

In America, with a larger scope, a recovery is under weigh, and a spirit of optimism prevails in many departments.

In Germany a report has been issued by the Wurttembergische Industrieverband, which shows that the metal trades have in recent months been hit very severely. There has been a reduction of working hours, and also of men employed, and generally the position in Germany is becoming worse, while other nations are beginning to see signs of improvement. The report warns the people of Germany against regarding the present situation too optimistically. The iron industry of that country is not recovering to anything like the extent that was expected; indeed, says the *Westminster Gazette* summary of the report, "there is marked stagnation of its activities. There was no sudden slump or crisis as in America, but a gradual diminution of business." On the other hand, America is showing signs of much more rapid improvement, whereas Germany's depression seems likely to hang on longer.

Some quotations may also be made from recent statements emanating from British electrical companies, on the past year's experiences and the present outlook:—

Lord Vaux of Harrowden, chairman of the *Brush Electrical Engineering Co., Ltd.*:—"They had been going through a period of extraordinary trade depression, and although the prospects now seemed a little brighter, they were still very far from having emerged from the state of stagnation into which business generally, and their own industry in particular, had fallen." . . . "Their competitors had all felt the pinch." . . . "A single good year of revived trade would put them straight again." . . . "They had lately met with substantial success in securing contracts of this class" (exhaust steam turbines).

Mr. G. F. N. Cornwallis-West, chairman of the *Potteries Electric Traction Co., Ltd.*: "General depression had existed throughout the country." . . . "nowhere was it worse than in the pottery districts." . . . "At the present moment there did not appear to be any great revival in the trade of the district." . . . "Trade throughout the world was suffering from general depression."

Callender's Cable & Construction Co., Ltd.—Annual report:—"The deplorable condition of the engineering

trade during the past 12 months in every part of the world is too well-known to need more than passing reference." "The electrical trade on the Continent has also suffered from depression and from unusually severe competition."

Mr. T. O. Callender, addressing the shareholders of the company last week, said that, although they had suffered temporarily, they believed that next year, or at least the year after, there would be a big boom in electrical supply. "Taking it all round, the directors were very glad to have seen the last of 1908, for they looked forward to better times. The earlier part of the year did not give much hope of the future, but recently there had been a distinct improvement. The demands from their old customers were increasing, and there was a decided movement towards extension elsewhere. The London orders began to show most excellent business. On the Continent . . . . things had been, if possible, worse than in England. In the latter part of 1908 there was a bitter warfare between the manufacturers of electrical plant, and work was undertaken at prices which were shocking . . . . Still things had improved on the Continent. The warfare seemed to have died out and better conditions prevailed, and the prospects there were decidedly better. They had recently received some very good orders. . . . In the Colonies there was a certain amount of promise, and in the past year their trade in Australia was better than for many years. There was a very decent business in South America, and elsewhere throughout the world there were a fair amount of general orders to be had—it was the price which was bad."

Sir Chas. Euan Smith, Lisbon Electric Tramways, Ltd.—"The political situation (in Portugal) had continued unfavourable in the past year, and consequently the general commercial situation had suffered." "The exchange had lately shown more firmness, which was a good indication of the gradual development of stability, both in politics and business."

British Westinghouse Electric Co.—Annual report:—"The falling off in the volume of business carried out during the year under review has been chiefly in the home markets." "Orders to date slightly exceed those for the corresponding period of last year. There is some appearance of a revival in trade, and it is to be hoped that the remainder of the year will show an improvement in the volume of business."

Johnson & Phillips, Ltd.—Annual report:—"The cable business . . . . shows signs of a decided improvement . . . The outlook is therefore promising, and the directors have every confidence in the good prospects for the ensuing year." Mr. Blackwell, addressing the company's meeting last week, said: "The work now in hand was much more lucrative, and there was more of it than they had at the corresponding period last year."

From these, and other statements like them, we see that the depression has been world-wide, that a panic in America affected every other country, that a cotton strike in England troubled the industries of India, that the Far Eastern countries have been nervous after the Russo-Japanese war and in presence of Indian sedition fed by the reckless Socialistic orator from home, and that Germany, though in some trades feeling the pinch later than other countries, is suffering severely now. Australia and New Zealand, and, perhaps, Canada, are about the only bright spots; in the first two there is quite a boom in progress. Russia ought to be soon in the midst of a great development, for there appears to be evidence of a greater quietness among her many millions, a quietness which may not help the cause of freedom—but we are not talking of that—a quietness which gives opportunity for industrial and trade progress.

A combination of world-causes seems to be at the bottom of the depression, toward the end of which we trust we are now approaching, and be on our guard all we may, we never shall be able effectively to protect ourselves against the consequences of wars and rumours of wars, whether they be nternational or the internecine struggles between capital and labour. It is the movements of the nations and the hearts of men as individuals that are responsible for much that affects industry, and who are they that profess to be able to exercise a dominating control over these? As the whole world awakens, it is inevitable as things stand, that conflict and rivalry there must be until a universal ideal—a millennium—has been attained. These things have got to be regarded as inevitabilities and to be reckoned with, and any effort that we in this country may make to level up the depressions in the trade curve due to external influences, can be of but little avail. But that does not release us from the duty of thoroughly investigating proposals that are brought forward with the idea of helping to reduce the depressions. So far as our recollection serves us, if the present depression is to be judged by the volumes of talk concerning it, the drop in the curve has been deeper than those that have preceded it, and has been more severely felt by capitalist and worker alike. The occurrence of exceptional external and internal troubles simultaneously may, perhaps, be the cause; and, no doubt, in the course of years, other times will bring similar combinations which shall adversely affect industry. Every generation has at some time the fever of the boom and the problems of trade depression. But it is not improbable that internally we may, by putting the best heads together, do something to prevent a part of the drop—that which is not due to the external causes to which we have referred.

We are developing a race of men who refuse to "grin and bear it." Our forefathers understood that "what can't be cured must be endured," and cures that are poor cures, even in the theory of their advocates, and in the minds of others only give prospects of being greater evils when carried into practice, were farthest from their thought. Free speech with the ignorant inflammatory diatribes stirring up bad blood that it generally carries; a Press with liberty (!) to tell its daily story and tabulate its own conceptions with all the semblance of a dictator's authority. These are our boast to-day! Individual liberty is a great and grand conception, but to allow liberty to a wild horse is quite another thing. And until the workmen of this country can be brought to see that there are two sides to the employment question, that they have an interest in helping the manufacturers of this kingdom to secure business that now goes to the foreigner, they are liable to do harm to themselves in agitating for what they regard as their rights, because they fail to recognise at present that every additional "right" they secure may make it harder for the employer to provide them with any work at all, because more pay and shorter hours can only help the competing foreigner to take the bread and butter out of their own mouths.

Humane considerations have taught us in this country to have regard for the well-being of the people as a whole. We have for many years directed a very large share of our effort, legislative and social, to the betterment of the conditions of the individual worker. We were wealthy, our hands were full of work, and we recognised the legitimate claims of honest toil, and in reason, step by step, we endeavoured to meet those claims. But things have been pressed too far, and we are all paying for it not only in lack of employment, but in added taxation, and the time has come when, in the interests of future industry, the brake must be applied.

(*To be concluded.*)

NOTES ON BRAZIL.

[BY A SPECIAL CORRESPONDENT.]

ALTHOUGH Brazil was discovered over 400 years ago, it may still be looked upon as a comparatively new country, and, like other new countries, has offered a fair field for civil engineers. "*Progresso e ordem*" is the motto it has adopted, and with the progress has naturally followed a demand for engineers in the other branches. Until recent years, however, this demand, as far as electrical engineers are concerned, has been but small; but there is every likelihood of it increasing, for now the country has, as one might say, reached to years of discretion, and settled down to develop its industries. It must not, however, be judged on the same standard as some of the British Colonies; it is the rule to go there first and secure the job afterwards, but the very opposite is the case in Brazil, few situations being procurable on the spot, most of the engineers already here having been engaged through the agents of the Brazilian companies in England, or, in the case of a British company, through their London office. It would be foolish indeed for a man to come here simply on the off-chance of being able to pick up a suitable job, no matter how competent he was, or how willing to work. It

must be remembered that Brazil, although an immense country, being 25 times bigger than the British Isles, is, as yet, but thinly populated, and therefore poorly developed, and, indeed, is in some places practically unexplored. The natural resources are, however, in proportion to the size of the country, the mineral wealth being very great.

Almost all the known metals may be found in Brazil, some of them in abundance, others, again, in deposits that would be at the present time unprofitable to work. They range from gold to iron, and include some of the rarer but now prominent metals, such as tungsten. Thorium is also found in the monasite sand around the coast of Bahia, and iron is said to abound, although scarcely worked as yet, most of the foundries in the country using imported metal.

In waterfalls, too, Brazil can be said to be fairly rich, some of these already having been harnessed. The Light and Power Co. of Rio Janeiro, for instance, have a hydro-electric station in operation. It is, perhaps, not generally known, that this country possesses a waterfall that rivals Niagara in size and capacity. This fall, known as Paulo Affonso, is situated some 250 miles from the capital of the State of Bahia on the River Sao Francisco. It has been calculated that the river discharges over the falls 27,786,000 gallons of water per minute, the height of the falls being given as 268 ft., and the width only from 45 to 54 ft. Here, then, is something like 2,000,000 H.P. going to waste, and only waiting until some enterprising party finds it profitable to harness it, and thus open up another field for the engineer.*

There are about 10,000 miles of railway in Brazil, and 2,000 or 3,000 miles, if not actually under construction, at least projected, but this appears quite inadequate considering the size of the country. Most of the railroads belong to the Federal Government, but many are leased to English companies, and the principal engineering positions held by Britishers. Much of the railway was, and still is, being constructed under the supervision of British engineers. The demand for electrical engineers in this department of engineering is, however, small, although naturally vacancies do occur now and then. The railways have, of course, their own telegraph system, and some of the carriages have electric lighting equipments, but beyond this, and, perhaps, a small number of generating sets for the lighting of staff quarters and workshops, few electrical appliances are used, little being attempted in the way of signalling. The writer has every reason to believe that some of the railway companies are seriously considering the advisability of introducing electric power into their workshops, and there is no doubt that only the recent strike amongst the employés of the Great Western of Brazil Railway, delayed that company's final decision on the matter. It has been reported, too, that the General Electric Co., of America, have secured a contract from the Brazilian Government for the electrification of 700 miles of track on the Central Railway near Rio Janeiro, but the writer is of opinion that only the suburban lines will be electrified in the meantime.

There are, perhaps, about a dozen towns altogether in Brazil which possess electric lighting and electric tramway systems, and about twice this number with electric lighting only. The largest company in this line is the Light and Power Co., of Rio Janeiro, which has recently taken over several other systems, including that of Bahia. Some of the supply systems are owned by Brazilian companies, but these, in many cases, are under the charge of a British engineer. Only the chief positions, however, in any of the various stations are held by foreigners, so that the vacancies which do occur are few. There are still quite a number of towns of over 15,000 inhabitants that have no public supply of electricity, and one town of 200,000 inhabitants, namely, Pernambuco, which has neither an electric light nor power supply, and is still content to get along with mules instead of motors in its trams.

Perhaps the widest scope offered at the present time for electrical or mechanical engineers is in connection with the factories or mills, of which there is a goodly number, for the high duty charged on all goods entering the country makes it profitable to manufacture behind those tariff walls when the raw material is at hand. The principal articles turned out from these factories are cotton goods, sugar, tobacco and rice, and there are also one or two breweries in operation, large enough to demand the services of an engineer. The number of cotton factories is estimated at 150, and these naturally must have some power for driving the looms, &c. The means adopted vary according to circumstances, some, for instance, utilising an available water supply, and driving direct off a water turbine and in some cases running in parallel with an engine. Others, again, have one large steam engine to do the work, while in the south of Brazil, where there is a fairly cheap supply of electricity, many have been installing motors as their driving power, and this method seems to be becoming recognised, and adopted where possible. The writer has not yet been able to visit any of the mills which have their own generating plant for supplying power, but he knows of one large mill near Pernambuco, and has seen the drawings of the intended arrangement which is on this principle. The projected scheme is to generate three-phase current and distribute this to single-phase motors driving groups of machines. The order for the first part of this electric installation has already been placed with Messrs. Brown, Boveri & Co., the generator being one of 750 KW., and the number of motors to commence with 100; the mill, however, is being laid out for several times this number. The writer has but little doubt that at least the chief electrical engineer chosen for this place will be other than a Brazilian, and probably a Britisher. In sugar refineries, tobacco factories, and rice mills, less machinery is, as a rule, used and less power, therefore, required, so that fewer British engineers are met with there. These places too, however, are awakening to the advantages of electricity, and where there is an available water supply within reasonable distance, are utilising it as a means to generate and transmit power to the factory. There is usually to be found at least one Britisher in most of the cotton mills, and very often that one is the engineer, either mechanical or electrical, according to the system used.

A favourite method adopted in some of the smaller mills, and in the very small electric lighting stations is, when some new machinery is required to be erected, to secure the services of an engineer on, say, a two-years' contract. This engineer, after putting down the new plant, overhauls the old machines, and gets the place into something like order. He is usually quite welcome to stay as long as he cares, but should he, for some reason, leave, his place is taken by his chief mechanic, who is almost invariably a Brazilian and who, by this time, may have become fairly useful. This man runs the place until more machinery is ordered and another engineer engaged, who, after erecting this new machinery, proceeds, like this predecessor, to again put the place in order. Not unfrequently, however, force of circumstances, in the form of a breakdown, compels the owner or company to send for an engineer, before it is necessary to order more machinery.

There are no electrical manufacturing companies in Brazil, the nearest approach to these being a few repair shops and contractors, here and there. In many of the smaller supply stations the chief engineer has a staff of native wiremen, who do all the wiring and repairing necessary for private lighting installations, this forming an additional source of income to the undertaking, and an additional source of worry to the engineer, for the average Brazilian wiremen form a class by themselves, not usually met with in Britain. Some of the work turned out by these men is enough to make the I.E.E. frame a new set of wiring rules, commencing with instructions not to fix a wire to the wall by driving a nail through the insulation.

The cost of living in Brazil varies, and the variations are probably more pronounced here than in other countries. For the same standard of living, the cost in one town may be nearly double that in another. The dearer towns are those in the interior, and the dearest those situated well up the Amazon. From Pernambuco south, the cost of living in any of the towns on or near the coast, may be estimated at from £15 to £20 per month, more or less according to the standard adopted by the individual. The cost for towns in the interior is slightly higher, and for those on the Amazon it may rise to £30 per month. The average charge for hotels through the country may be put down at from 10s. to 15s. per day, or if by the month,

* As announced in our issue of May 21st, page 849, an American investigation party has lately been inspecting these Falls, with a view to their exploitation.

about £10. In many of the larger towns there are German and English Pensions where the charge is slightly higher than at hotels, but the comforts greater. Excepting food and tobacco, everything else may be safely put down at three times the price paid for the same quality of article at home, so that it behoves intending visitors to get a good outfit before leaving England and risk having to pay duty on the articles here.

Any light clothing is suitable for Brazil, but Britishers almost invariably wear white clothes, with the exception of in Rio Janeiro where this fashion is not so pronounced. Where white clothes are worn the washing bill, although rather a prosaic subject and usually put down under the heading of sundries, may, nevertheless, form quite an appreciable item of expenditure, averaging 30s. per month, and in the more expensive towns easily doubling this figure.

In a country extending as Brazil does for some 2,600 miles from north to south, one would naturally expect to find some variations in the climatic conditions, and such is the case. In certain places the climate could scarcely be called salubrious, but these places are of but little account, and on the whole, Brazil may be said to be quite a healthy country, although the heat is at times trying. In the coast towns this heat is usually tempered by the sea breeze, and provided suitable clothing is worn, no inconvenience need ever be experienced.

Now that the rate of exchange in Brazil is practically fixed, there is no risk in accepting a situation on a certain number of milreis per month, for these may be calculated at 16 to the £. In the same way, if the contract states so many "£'s to be paid in milreis at the rate of exchange of the day," the recipient will lose but a fraction per cent., in changing back into £'s sterling.

As regards amusements, the Britisher will find himself but poorly provided for here, either in comparison with home or the Colonies, for the Brazilian is an indifferent sportsman, and gives but little thought to recreation. This, of course, is always excepting Rio Janeiro, which being a large town with a big foreign element, is fairly European in tastes, if not in sympathies. True, in other towns where there is a British colony of any size, various clubs exist, cricket and tennis being favourities, but as a rule one has to make one's own amusement; theatres are to be found in most towns, but these are generally not of much account, the companies visiting them being neither numerous, nor talented.

The electrical engineers most suitable for Brazil are competent men with an all-round experience, capable of tackling anything, from the rewinding of an armature, to the building of a new chimney—engineering here not yet having reached the stage where specialists are kept for each separate branch of work. Portuguese is, of course, the language of the country, but engineers at home do not usually include this one in their curriculum; a knowledge of Spanish or French, or, in fact, any Latin language will, however, be found beneficial. Engineers coming out here will always find it to their advantage if they can pick up even a smattering of Portuguese before arriving, more especially if they have the handling of men; should any difficulty arise, however, in respect to the language, some English-speaking person is sure to be at hand. A question invariably asked by newcomers is, How long does it take to learn the language? This, of course, is impossible to answer, for some can talk fairly fluently after five or six months, while others, again, can hardly frame a correct sentence at the end of as many years. In those cases where a knowledge of Portuguese is most essential, it is remarkable how quickly it can be learned; but under ordinary circumstances, anyone ought to be able to make himself fairly well understood after six months' residence in the country, although he can hardly expect to be able to join in a general conversation in such a short time. In most of the engineering situations here, the language may be put down as a secondary consideration, and the want of it need not deter any one from accepting an appointment, but be sure of the appointment first, for even to those who are fluent in Portuguese, but do not know Brazil, the writer still considers that coming out here to look for a job would be a foolish and expensive undertaking and the chance of success but small.

LEGAL.

THE CONSOLIDATED NICKEL, TIN AND COPPER MINES, LTD., v. CROMPTON & CO., LTD.

(*Continued from page* 883.)

MR. J. C. MACFARLANE, M.I.E.E., examined, said he was in charge of the main shop at the works of Messrs. Crompton, at Chelmsford, and all the large motors were turned out under his supervision. He remembered the motor supplied to the plaintiff company. Messrs. Crompton manufactured a very considerable number of motors of the same style and strength every year, and supplied a good many of them for the purpose of pumping in mines. Before the motor left the works it was tested. It was the practice of the company to test a motor at its full load before dispatch, but in the present case that was not done. The distance between the bearings was about 27 in., which, in his opinion, was right. At the end of August the motor was sent to the Redruth Foundry, and the air gap was increased from $\frac{1}{100}$ to $\frac{1}{150}$ of an inch. That would not decrease the power factor more than 1 per cent. On September 13th the main bearing of the motor seized, and on September 26th it was returned to Chelmsford. He found then that several of the stator coils were entirely burnt out. He thought at the time the trouble was entirely due to starting up the plant. He did not think that what had happened was due to any defect in the motor itself. The exciter voltage in this case was exactly suited to the work. Further examined, WITNESS said that when one or two of the bars of the motor were burnt out the effect upon the bearings was very great by reason of the fact that the rotor was pulled on one side by the magnetism of the stator. There was no necessity to have an ampere-meter recording more than 100 amperes. If the plant had been started up properly the amperes would have come down within half a minute to the normal working amperes of 50 or 60.

Cross-examined by MR. RUSSELL., K.C., WITNESS said he was unable to say whether as late as December 10th, 1907, they had not made up their minds whether or not a starting switch should be used. At one time he thought that the use of a transformer would be a desirable method of starting up the motor. He disagreed that a ventilated motor of the same size as a 55-H.P. totally enclosed machine would be rated at 100 H.P. The motor supplied to the plaintiffs was constructed with a large number of radiating gills, and motors of this type, if ventilated, would not give more than 25 per cent. increased power. By drilling holes in the cover and inserting fan blades on the rotor they converted the machine into a partially enclosed one. Such ventilation would certainly increase the capacity of the motor.

Re-examined, WITNESS stated that a rise of 100° F. in the stator windings of a totally enclosed motor was not an improper rise. In ventilated motors there was always a draught of air passing across the windings, and consequently the thermometer did not indicate the actual rise of temperature. This was not the case in a totally enclosed motor, and the thermometer indicated the actual internal temperature of the windings. A reasonable temperature for a motor of that description doing 55 H.P. would be, at the outside, 100°, and with 60 H.P. it would take 20 per cent. more, making the maximum rise 120° F. After eight hours' running, the temperature would not go beyond this maximum.

On May 28th, in further cross-examination, MR. MACFARLANE said that when a motor fell out of step it took much more than the normal current, and if such condition was allowed to continue, after a certain time, the motor would burn out. The chief reason why he came to the conclusion that it was advisable to make the motor partly ventilated was because of the burning out. His firm made as many machines without starters as with.

MR. ALAN WILLIAMS gave evidence as to the suitability of the plant for its purpose.

MR. ABEL THOMAS asked whether fuses were any protection against overloading such as that which had been mentioned. WITNESS replied that fuses were really no protection against overloading at all. They were provided to protect the alternator, the switchboard and the main cables in the event of a short-circuit owing to injury to the cable. With reference to the fact that the armature of the machine revolved whilst the fields were stationary, witness said that although defendant had specified the reverse type, the machine installed was the better type for the work it had to do. For the output required in this particular case it was important to have a massive field with plenty of copper winding on it, and a relatively lighter armature. This being the case, it was naturally better to revolve the lighter armature than the heavy field, and it was also easier to provide the necessary weight of copper and iron on the field if it were stationary. Greater facilities were also provided for fixing the copper in position. Regarding the fly-wheels, WITNESS said that the weight of the fly-wheels was quite sufficient, as in the case of a pumping plant the load was constant. Referring to the breakdown which occurred whilst he was at the mine, WITNESS said that the man in charge of the plant did not know what to do. With a reasonable amount of skill and attention, the whole plant was perfectly well able to do the work required of it. He had not the slightest doubt that the burning-out of the motor in September, November and December was caused by reduction in the mean speed of the alternator due to bad gas, slipping belt and

other causes, which might all have been avoided had those in charge of the plant used care and skill.

Cross-examined by Mr. Schiller, Witness said the reason why the defendants specified to plaintiffs a revolving field machine was because it was their standard type. At that time they had not disassociated machines, such as the one in the mine, from their standard machines for mining work. He would not say with regard to fuses that they were never used as a safeguard against overloading, but they were very seldom employed against overloading.

Mr. H. R. J. Burstall, examined, said that on February 27th, 1908, he attended at Messrs. Crompton's works at Chelmsford, and saw the motor which was now at work at Chacewater while under test. It was started at 8.30 a.m. and ran until 2.30 p.m. The average load was about 70 H.P.; 70 amperes by 480 volts was his note. It was then stopped for five minutes, and then it ran on until 4 p.m. at a load of 88 amperes — over 90 H.P. The normal power of the machine was specified at 55 H.P., so that for the first part of the test it was considerably overloaded. When it was stopped the stator was 160° F. outside, the temperature of the air being 64. The rotor was very hot—about 250°, he thought. Even with that overload and with that temperature, there was no sign of softening of the insulating varnish in the stator. The temperature of 250° had not damaged the rotor in any way. The machine ran well during the test. The bearings were cool. During the test the power factor varied between ·91 and ·92. He did not think that the want of a steadying bearing had anything to do with the first breakdown. The capacity of the motor would be increased by ventilating it, and it would be able to take a heavier over-load without overheating. The addition of ventilation would not have converted an inefficient machine into an efficient one. On March 5th, 1908, he visited the mine in company with Mr. Williams, and saw the whole of the installation above ground. He then found that the motor was either out of step or was stopped. He found that the main switch had been allowed to remain in; this allowed the current to pass through the motor, which was liable to damage the motor. Somebody, too, had dropped the exciter amperes. He thought the reason of the failures on these occasions was from the belt slipping so much that they could not get enough pressure on the alternator, and that would cause the motor to fall out of step. Afterwards the old belt was put back and the machine started satisfactorily. He had seen the specification and the letter of Messrs. Crompton dated February 12th. The plant installed was of the ordinary type. The armature in this case was revolving, which was different from that specified, but that made no difference from a customer's point of view. He thought the fly-wheels were suitable for the job, and that the governor was suitable, with proper adjustment. He thought an auto-transformer was not necessary, because you could get the same effect by lowering the volts on the alternator.

Cross-examined, Witness said that it was an ordinary type of low-tension alternator. He did not take the governor to pieces. Fuses were usually put in for the purpose of protecting the motor. He had machines of 2,000 KW. running absolutely unprotected at the present time. At Chacewater the line was protected, but not the motor. He did not believe in automatic appliances where they had men in charge, because they led to carelessness.

Mr. Abel Thomas then proceeded to address the Court on behalf of the defendants, and the learned Official Referee reserved judgment.

Maxwell, Son & Co. *v.* Williams.

A settlement has been arrived at in an action by Maxwell, Son and Co., electrical engineers, St. Andrew's Street, Dundee, against R. A. P. Williams, late of the Gaiety Theatre, Dundee. The pursuers sued for £249, being balance of an account due by defender for work done at the theatre. When the action was first raised the defence was that the account was overcharged, and that the work was imperfectly carried out. The Sheriff remitted to a competent authority to examine the work, but it was intimated that the action had been amicably settled.

Arundell *v.* Robinson.

In the King's Bench Division, on Wednesday, May 26th, before Mr. Justice Pickford, an action was brought by Robert Adams Arundell, of 46, Bushwood Road, Kew, and Clifton Works, 23, Grove Park, Chiswick, against Benjamin T. Robinson, of 77, Addison Road, Kensington, to recover £102 19s. 9d., balance of the price of work and labour done and materials supplied in connection with the installation of electric light fittings at 77, Addison Road. Defendant had paid plaintiff £16 10s. 10d. since the action was brought, and admitted that, subject to his counter-claim, there was a further sum of £35 due. He asserted that it was a term of the agreement that the prices charged for the work and labour done and materials supplied should be the usual charges; that the fittings should be ordered from the Edison and Swan Electric Light Co., Ltd., and defendant had the benefit of the trade discount of 33⅓ per cent., subject to plaintiff's discount of 2½ per cent., and that the work was to be done according to specification, and to the satisfaction of the defendant and Mr. Paul Hoffmann, architect. The contract was completed in June, 1908, and on October 20th Mr. Hoffmann directed plaintiff to make good certain defects for which he was responsible under the terms of the contract. Plaintiff had failed to do the work, and the defendant counter-claimed £35.

Plaintiff, in reply, maintained that the work had been done according to specification, and asserted that the architect indefinitely postponed the work of remedying the alleged defects which he (plaintiff) was ready and willing to execute on the terms of the specification.

Mr. T. W. H. Inskip appeared for plaintiff, and Mr. E. Grimwood Mears was counsel for defendant.

In the result, his Lordship found for the plaintiff on the claim and counter-claim.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CYPRUS.—The following duties are leviable on electrical and similar goods:—

Brass manufactures	10 % ad val.
Copper sheets, bottoms, bars and nails ...	12s. per 100 okes.
Copper wares	20s. " "
Earthenware and china	10 % ad val.
Glass, except bottles, window glass and demijohns	" "
Iron bars, joists, rods, plates, sheets and bundles	13s. 6d. per ton.
Iron piping, wrought	2s. 2½d. per 100 okes.
" cast	1s. 9¼d. " "
Other iron and steel goods, except nails ...	10 % ad val.
Lead sheets and lead piping	½d. per oke.
Steel	3s. 1½d. per 100 okes.
Machines and parts thereof...	free.
Street lamps and their fittings imported by Municipal Councils, to be used in lighting the streets within the municipal limits, and duly certified as so imported...	free.
Tools and implements	"
Goods not specially mentioned in the Tariff	8 % ad val.

The value on which *ad valorem* duty is calculated is the value at the place of shipment or purchase of the goods, with the addition of cost of transport (including insurance) as far as the port of final discharge.

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this Journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,576. "Carbon contact collecting gear for electric cranes and the like." C. L. Creed and J. Watson. May 17th.

11,578. "Arc lamp with conducting supporting member." B. Duschnitz. (Date applied for under Sec. 91 of the Act, September 22nd, 1908, being date of application in Germany.) May 17th. (Complete.)

11,579. "Arc lamp in which the feed of the electrodes is effected by the action of the current at the point of support." B. Duschnitz. (Date applied for under Sec. 91 of the Act, June 30th, 1908, being date of application in Germany.) May 17th. (Complete.)

11,605. "Improvements in electrical switches." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. May 17th. (Complete.)

11,634. "Improvements in or relating to electric meters." Siemens-Schuckert Werke G.m.b.H. (Date applied for under Sec. 91 of the Act, May 19th, 1908, being date of application in Germany.) May 17th. (Complete.)

11,648. "Improvements in portable electric batteries for lighting and ventilating." O. Koulen and W. Walser. May 17th.

11,679. "Improvements in electric traction." M. Churchill-Shann. May 18th.

11,720. "Improvements relating to the control of electric circuits." W. A. Price. May 18th.

11,741. "Improvements in holders for electric candle lamps." C. C. Regnart and Huntalite, Ltd. (Application for Patent of Addition to No. 20,010/04. May 18th. (Complete.)

11,760. "Improved electrolyte for use in electric batteries." New Ignition Syndicate, Ltd., and W. J. L. Sandy. (Application for Patent of Addition to No. 10,520/08.) May 18th.

11,767. "Improvements in electrical switches." P. M. Donaldson (J. Donaldson, United States). May 19th.

11,773. "Improvements connected with ceiling roses, junction boxes, conduit boxes and the like electric fittings. S. Johnston. May 19th.

11,822. "Improvements in and relating to dynamo-electric machinery." The Hon. C. A. Parsons and A. H. Law. (Date applied for under Rule 13, August 8th, 1908. An invention comprised in application No. 16,701 dated August 8th, 1908.) May 19th.

11,842. "Improvements in regenerators for use in the electro-zincing process." S. O. Cowper-Coles. May 19th.

11,843. "Compound anode and cathode bars." S. O. Cowper-Coles. May 19th.

11,866. "Improved method of preventing leakage of electrolyte from electric storage batteries." R. Pape. May 20th.

11,880. "Improvements in electric motors and dynamos." Veritie, Ltd., and P. A. Hirsch. May 20th.

11,900. "Improved slot for electric lamp-holders and the like." O. Baker. May 20th.

11,904. "Improvements in commutators for dynamo-electric machines." Siemens Schuckertwerke G.m.b.H. (Application for Patent of Addition to No. 4,240/1908. Date applied for under Sec. 91 of the Act, July 31st, 1908, being date of application in Germany.) May 20th. (Complete.)

11,906. "Improvements in boxes or jars for electric batteries." J. T. Szek. May 20th.

11,926. "Improved electrolyte for primary batteries and a preparation to be employed in making such electrolyte." B. E. R. Newlands and R. M. Parkinson. May 20th.

11,938. "Improvements in connection with the generation of electric energy and apparatus therefor." W. S. Simpson. May 20th.

11,947. "Improvements in or relating to current collectors for electric traction systems." E. M. Munro and Railless Electric Traction Co., Ltd. May 20th.

11,950. "Improvements relating to dynamo-electric machines." M. Walker. May 20th.

11,958. "Improvements in methods of charging and discharging secondary batteries or electric accumulators." A. M. Taylor. May 21st.

11,981. "Novel or improved flexible protection for electric cables and the like purposes." E. L. Pease. May 21st.

12,005. "Apparatus for forming and transforming cipher messages for telegraphic and other purposes." R. T. Nicholson and H. W. Higham. May 21st.

12,016. "Improvements in and relating to apparatus for use in charging electric accumulators." J. Polkey. May 21st.

12,047. "Improvements in and relating to the control of electric motors." British Thomson-Houston Co., Ltd., and K. F. Kingwell. May 21st.

12,048. "Improvements in and relating to electric distribution systems." British Thomson-Houston Co., Ltd., and E. B. Wedmore. May 21st.

12,060. "Improvements in or relating to controllers for electric motors." P. S. Turner. May 21st.

12,063. "Improvements in electric motors for toys and models." J. F. Parker. May 21st.

12,066. "Improved method of electrical wiring." J. S. Swainson and F. B. Swainson. May 22nd.

12,139. "Method of and means for controlling and indicating the condition of control of electrically propelled tramcars and other vehicles." W. E. Ireland. May 22nd.

12,146. "Improvements in and relating to electrical conductors." C. Vernier. May 22nd.

EXPIRING PATENTS.

(*Concluded from page* 908.)

15,215. August 18th, 1895. "Printing telegraphs." C. L. Buckingham.—Relates to telegraphic printing apparatus arranged to print in sheet form, and, by substituting a suitable keyboard for relay and distributing arrangements, as an electro-magnetic typewriter. The receivers are constructed to record the message in page form on paper placed round a cylinder and caused to move axially and circumferentially. The signals are preferably sent automatically, and at the receiving apparatus the currents cause two series of adjusting levers to operate so as to bring the required type to the printing position, when a final long current actuates the printing magnets.

15,445. August 16th, 1895. "Printing telegraphs." W. S. Fteljes.—Relates to printing receivers arranged with a type wheel driven by clockwork and controlled by a double escape wheel having an oscillating pawl connected by a lever to the oscillating armature of a magnet. Alternating currents excite this magnet, and also pass through a sluggish magnet, which only releases its armature when the alternating currents cease.

17,328. September 17th, 1895. "Automatic musical instruments." G. H. Davis.—Relates to an electrical device for playing pianos. A roller driven by an electromotor actuates a roller, on which a tune sheet is wound on a frame. The tune sheet passes over a metal roller, with which spring fingers make contact when permitted to do so by the perforation in the tune sheet. Electromagnets are thus energised and cause swinging arms to come into contact with the roller. Stickers are thus forced upwards against the keys, and the piano action is thus operated.

17,745. September 23rd, 1895. "Electrolysis: galvanic batteries." H. H. Lake. (C. Hoepfner.)—Relates to using for electrolysis and for galvanic batteries, what are termed "energy saving anodes," consisting of anodes which are soluble, and form a solution which is kept separate from the cathode liquid, and from which the metallic constituent is easily precipitated for re-use or for other purposes. The cathode compartment is filled with the liquid to be decomposed—in this case a zinc salt or an alkaline solution of zinc oxide—and the cathodes are formed of any suitable metal capable of being heated from within and kept in motion.

19,402. October 16th, 1895. "Electric railways, &c." W. E. Heys. (G. Knapp.)—Relates to the return circuits. The shortest return feeder is made of as low resistance as possible, and the others have resistances proportional to loss of power and outlay. Into such return feeders as have appreciable resistance, storage batteries or dynamos acting as sources of E.M.F., are inserted to promote the flow of return currents, and the E.M.F.'s are adjusted so that each return carries current corresponding to the track served by it.

19,454. October 16th, 1895. "Railway signals." W. R. Sykes.—Relates to means whereby two or more signals may be operated by one lever, the position of the points determining which of the signals shall be operated, and also to means for preventing malicious tampering with the signals. The invention is shown as applied to four signals operated from one lever.

19,866. October 22nd, 1895. "Electric coils." R. Belfield. (O. B. Shallenberger.)—The object is to construct a coil in such a manner that the magnetic field produced by the current shall have a desired phase relationship with the E.M.F. producing the current. The field coil is connected in series with an induction coil. A second coil is shown at right angles to the field coil, and is connected in series with a resistance having small self-induction. In order to make the field produced by the field coil approach more nearly to exact quadrature with the field produced by the second coil, an auxiliary closed coil or conductor is introduced within the field coil. An adjustable resistance may be included within the circuit of the auxiliary coil. Several modified forms of this coil are described.

20,023. October 24th, 1895. "Dynamos." F. J and R. Chaplin.—Brushes. A dynamo brush is composed of a bundle of crimped fine copper wires, with or without a copper gauze or like covering.

21,283. November 9th, 1895. "Electrodeposition." A. S. Elmore. (J. O. S. Elmore.)—To effect a rapid electro-deposit of metals, a very large volume of the electrolyte is caused to flow through narrow spaces between the anodes and the cathodes, and a current of much higher density than usual employed. A tank is provided with a rotating mandrel surrounded closely and entirely or partly by anode plates. The electrolyte is forced by a pump through openings and out through tubes back to the pump. In the modified form, cross partitions cause the whole of the liquid to pass between the anode and mandrel. The metal may be burnished as it is deposited.

21,357. November 11th, 1895. "Telegraphy and telephony." E. J. P. Mercadier and H. R. J. Pierquin.—Relates to duplex systems of telegraphs, telephones, the combination of both or the use of either on a system of electric distribution.

21,569. November 13th, 1895. "Railway signals, &c." W. R. Sykes.—Relates to lock and block signalling on railways, and more particularly to interlocking the signal levers with the block instruments.

21,924. November 18th, 1895. "Electric meters." G. Hummel.—Energy meters of the motor type for alternating currents. In order to render the speed of a Ferraris motor proportional to the rate of expenditure of energy in watts, the field magnet is wound with coils forming closed circuits, in addition to the winding carrying the current to be measured. Or a non-inductive coil may be arranged as a shunt to the main winding. An adjustable iron piece attached to the copper disk armature prevents the rotation of the latter by the shunt current alone.

23,127. December 3rd, 1895. "Lamps." W. Ackroyd and W. Bret.—Relates to miners' and like safety lamps. The lamp parts are locked together by a vertical spring bolt in the bottom engaging with a projection on the frame. The lamp is unlocked by the aid of an electromagnet.

24,677. December 23rd, 1895. "Supporting electric conductors." T. Laurie.—Relates to supports for conductors so constructed that the flexible conductor or conductors are attached at intervals to runners. The runners slide along horizontal rods or other supports, such as wire ropes.

24,702. December 24th, 1895. "Railway switches and signals." Westinghouse Brake Co. (J. P. Coleman.)—Relates to improvements on the invention described in Specification No. 2,248, A.D. 1891, for controlling, interlocking and indicating the positions of the switches and signals, by electricity, or by fluid, pneumatic or other pressure appliances. The present invention comprises improved arrangements of the electrical conductors for locking the switches and the make and break mechanisms for indicating their positions.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Method of and Apparatus for Starting Internal-Combustion Engines by Electrical Ignition. Firm of R. Bosch. 4,187. February 24th. (Date applied for under International Convention, October 28th, 1907.)

Electrically-Driven Percussive Tools, Specially Applicable for Rock Drilling or Stoping. J. Knight. 8,930. April 24th.

Generators for High-Frequency Electric Currents. J. G. Balsillie. 8,972. April 24th.

Electric Transformers. Akt.-Ges. Brown, Boveri et Cie. 9,146. April 27th. (Date applied for under International Convention, April 26th, 1907.)

Device for Opening and Closing an Electrical Circuit, more Particularly Intended for Testing the Ignition of Multiple-Cylinder Internal-Combustion Engines. F. H. Wynne. 9,166. April 28th.

Electric Time Alarm Apparatus. G. E. Marston and A. Pope. 9,211. April 28th.

Electric Arc Lamps. C. A. Carpenter and R. Banks. 9,222. April 28th.

Electrically-Controlled Clocks. W. T. Giles. 9,229. April 28th.

Electric Arc Lamps. A. D. Jones. 9,241. April 29th. (Request under Sec. 19 not granted.)

Mechanical Connectors for Electric Cables. J. Stratton and E. Claremont. 9,323. April 30th.

Closure Devices for Telephone Mouthpieces. H. A. Cutmore. 9,681. May 2nd.

Miners' Electric Lamps. P. M. Justice. (Deutsche Gasglulicht Akt.-Ges. Auergesellschaft.) 9,654. May 4th.

Apparatus for the Production of Electrotypes and for Electroplating. S. O. Cowper-Coles. 9,695. May 4th.

Disinfected Mouthpiece and Ear-Caps for Attaching to Existing Mouthpieces and Ear-Caps of Telephones. A. C. Good. 13,842. June 30th. (Post-dated December 30th, 1908.)

Dynamo-Electric Machines. T. Ferguson. 17,811. August 8th.

Equalising Devices for Alternating-Current Circuits. W. Cooper. 18,330. September 1st. (Date applied for under International Convention, September 3rd, 1907.)

Point-Shifting Arrangements for Electric Tramways and the like. J. P. Tierney and J. Malone. 18,822. September 8th. (Application for Patent of Addition to No. 12,928/08.)

Form of Electrical Cooking Vessel. G. Cooper. (F. Boelling.) 21,494. October 10th.

Locking Hook for Trolleys or Collectors of Electric Tramcars. J. Curran and E. Kelly. 23,002. October 29th. (Application for Patent of Addition to No. 13,299/08.)

Automatic Switches, Especially Adapted for Use in Charging Secondary Batteries. C. J. Bennett. 24,047. November 10th.

Magneto Ignition Apparatus. Soc. Anon. Montbarbon. 24,737. November 17th. (Date applied for under International Convention, December 15th, 1907.)

Process for the Avoidance of Hollow Spaces in the Production of Incandescence Filaments for Electric Incandescence Lamps from Colloidal Filaments. H. Kuzel. 25,443. November 25th. (Date applied for under International Convention, October 15th, 1908.)

Means for Conducting Current to or from Continuous-Current Electrical Machines. J. A. Johnsen and C. A. Walleen. 26,507. December 8th.

Electric Resonance Apparatus. Hartmann & Braun Akt.-Ges. 27,890. December 11th. (Date applied for under International Convention, June 12th, 1908.)

1909.

Apparatus for Producing Electrical Oscillations of High Frequency. Poukert. 4,762. February 26th. (Date applied for under International Convention, March 17th, 1908.)

Apparatus for Electromagnetic Separation. F. Steinert and H. Stein. 6,267. March 16th. (Application for Patent of Addition to No. 6,829/08.) (Date applied for under Rule 13, March 21st, 1908.)

Japan.—The following information is from the report by the British Vice-Consul at Osaka (Mr. A. R. Firth) on the trade of that district in 1908, which will shortly be issued:—In the supply of electrical machinery, equipment, &c., there has been active competition between British, American and German manufacturers. Until recently an American firm had practically a monopoly in the Osaka district, but latterly British and German firms have secured contracts. With the opening up of electric railways and the extension of various electric light companies, it is probable that large quantities of electrical machinery, &c., will be required during the next few years. It is impossible for British manufacturers to secure contracts for machinery, &c., unless they have an experienced representative on the spot, as a knowledge of local and personal considerations and the methods of tendering, &c., is absolutely essential.—*Board of Trade Journal.*